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THE DEER OF CALIFORNIA.

By E. RAYMOND HALL.

MAN'S INTEREST IN, AND USES OF, DEER.

If each person in California should list all animals of the state in order of their interest to him, I doubt not but that deer would top the list when all votes were cast. Much the same result would be expected in any state and, for that matter, in most countries of the world. This is primarily explained by the many uses man has found

it possible to make of deer. Also, because deer are found native on all continents except Australia and most of Africa, they are known to peoples of practically all lands. Furthermore this interest is of early origin for even the Neanderthal man, a now extinct race that lived some 50,000 years ago in southern Europe, left drawings of members of the deer family on walls of caves. Indeed, certain implements left by Neanderthal man were made from the bones of deer. Probably deer were valued also by primitive men that lived long before the Neanderthal race.

Certainly deer were of extreme importance to many primitive peoples. For example, certain North American Indian tribes not only relied on deer as a staple article of food, but from the deer's skin prepared buckskin that was used for making moccasins, clothing, tepees, thread and a variety of other things. Needles, awls, scrapers of certain kinds, some ornaments, arrow straighteners and a multitude of other articles were made from the bones of deer.

In the early settlement of North America by the white race, deer were of great importance, especially as a source of meat supply to the explorers and pioneers. Buckskin was quite as useful to these people as to the Indians. After settlements were established in many parts of the new country, deer hunting constituted a profitable occupation. Many deer were sold in the public markets for food. More were killed for their hides. Some idea of the vast numbers killed for this purpose is had from the fact that in 1880 the forwarding firm of Bush and Johnson, of Redding, California, handled 35,000 deer hides all obtained in Siskiyou, Trinity and Shasta counties. The average price paid was fifty cents per hide. Two men alone are said to have shipped 3000 skins to San Francisco in one year. However, this soon had to be discontinued, for with the rapid settlement of the country, extinction of the deer was imminent.

The uses made of deer at the present time are many. There is the use that scientists make of many animals. Every kind of animal, since obviously no two species are alike, is of value to the scientist but the deer is of particular value since it is one of the few large mammals that still exists throughout much of its former range. This is especially true in California, for here man has not transplanted one form into the territory of another and thus caused an unnatural mixing of kinds as, unfortunately, has been done in some parts of our country. Wise protection must be based on a knowledge of the life history and habits of deer as determined by the scientist.

The aesthetic and recreational value of deer is well known. Deer have an aesthetic value to anyone who enjoys seeing them or who enjoys knowing that they occur in a given region. Mere knowledge that deer exist in a given tract of woodland at once endows this with added interest to most persons. The ever growing number of people, nature lovers as they commonly are called, are especially interested in preserving the deer because of their aesthetic value. These people, for instance, derive more pleasure from hunting deer with a camera than with a gun, and take keen delight in observing the animal in the wild and studying its habits. Frequently these observations are of real merit and are contributions to science, but it is, of course, coming to be more generally understood that aesthetic uses are self-sufficient; that is, scientific or direct dollar and cents values need not be attached

to many things to justify their usefulness. However, it may be pointed out that the recreational value of deer is fully as great to this type of person as it is to the hunter.

In 1926 there were 252,017 hunting licenses sold in California. With the creation of a new deer license law it was estimated that 75,000 licenses to take deer would be sold in the fall of 1927. At the end of the first month of the 1927 deer season, close to 5400 bucks had been taken. The annual toll is close to 12,000. Every one of the thousands of hunters has considerable sums invested in hunting equipment. They spend lavishly in travel. Because deer are abundant in California the hunters' investment totals several millions and their annual expense is considerable.

Statistics such as these indicate that thousands are interested in deer hunting in California; that deer have great recreational value. Many persons share in the enjoyment of the venison from each deer. In food value alone, without considering the worthwhile recreation furnished by the hunt, deer constitute one of the greatest game resources of the state.

In spite of the popularity of deer hunting and of an increasing human population, deer in California are holding their own as regards numbers. The state boasts of deer in practically every county. Numerous refuges to safeguard a breeding stock have been created. No radical reduction in either season or bag limit has been made in recent years. Sport for the hunter is still at hand.

At the present time, then, deer may be thought of as having scientific, recreational and aesthetic values which unite to give this animal a high standing in the mind of every citizen.

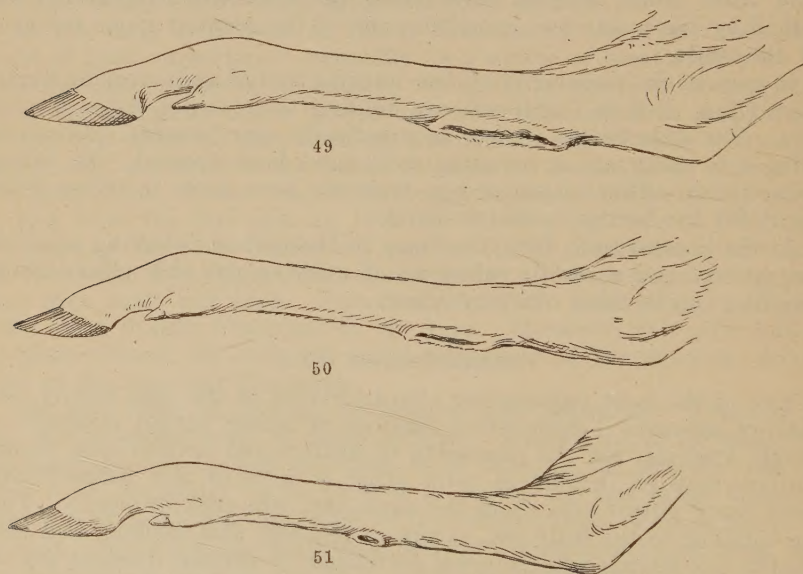
CHARACTERS OF DEER.

Two of the most outstanding characteristics of the deer family, that sharply separate it from other families of living hoofed mammals of North America, are the possession of antlers and several skin glands. Antlers may be defined as solid (that is without any differentiated core) bony outgrowths from the skull that are shed annually. They are confined to the male sex, except in reindeer and caribou, and their growth is controlled by internal secretions of certain ductless glands. At rare intervals females with antlers are found, but at least some of these individuals probably possess primary sex characters of both the female and male and are what are popularly termed hermaphrodites.

The antlers vary markedly with age. In the second fall a single spike represents each antler in most species, although in the mule deer this first antler is commonly forked and the same condition may occur in other species. In general, but by no means always, an extra point is added each year until the buck is five or six years old. After the sixth or seventh year the antlers commonly are not so large and the points may become fewer in succeeding years until, in old animals generally deficient in vigor, the antlers may be noticeably malformed and no more than mere spikes. Obviously, therefore, the number of points on the antlers furnishes no reliable guide to the deer's age. It may be mentioned that all malformed antlers are not due to old age. Some are due to early injury to the antlers themselves, and others are due to injury to the sex organs.

Each new antler begins to grow out from the base, or pedicle, in early spring, and until fully formed, is covered with a soft, hairy skin to which the appropriate name velvet has been given. In fall, the tips become hard and the velvet is stripped off, at least partly, by the deer's rubbing it against objects. Free of velvet, the antlers in time become smooth and polished except low down on the main shaft. They are displayed in this condition during the rutting season and are the weapons with which the bucks do combat with one another. Soon after the mating season, the antlers are lost and new ones shortly begin to grow.

Because of their porous nature these shed antlers soon decay if left exposed to the elements, as most of them are. They are also much gnawed by porcupines, mice and other rodents, all of which hastens their deterioration. These facts account for so few being seen in regions where deer occur.



FIGS. 49-51. Left hind legs of deer to show relative size and position of metatarsal gland in each (after Seton, *Life Histories of Northern Animals*, 1909). 49, mule deer; 50, black-tailed deer; 51, white-tailed deer.

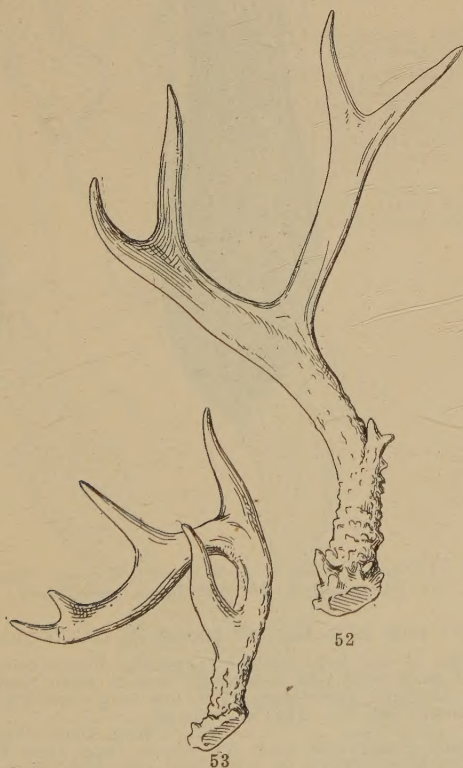
Antlers, because they occur on one sex only, furnish a secondary sex character. Other conspicuous secondary sex characters of the male are furnished by his generally larger size and broader hoofs. The great enlargement of the male's neck at mating time might also be included here.

The skin glands, mentioned above, occur alike in both sexes. Pouches, or tubes as they sometimes are called, glandular in function, are found between the hoofs, and a glandular area is located just below each eye in what is called the lachrymal pit. On the inside of the hock there is another glandular area marked by long hair, but the most striking gland of this type is that located on the back of the hind leg between the hock and foot and called, on account of its position on the metatarsus, the metatarsal gland. (See Figs. 49, 50, 51.) The opening or

surface of the gland proper is bounded by long stiff hairs which lap over it but because of their great length clearly indicate its position. The characteristic deer odor mainly emanates from the two metatarsal glands.

A hunter speaks of the deer "in the blue" and "in the red." These popular expressions serve in a way to denote the seasonal variation in the color of deer. They are, however, not thoroughly accurate, for the winter coat is grayish and the summer coat more brown in color.

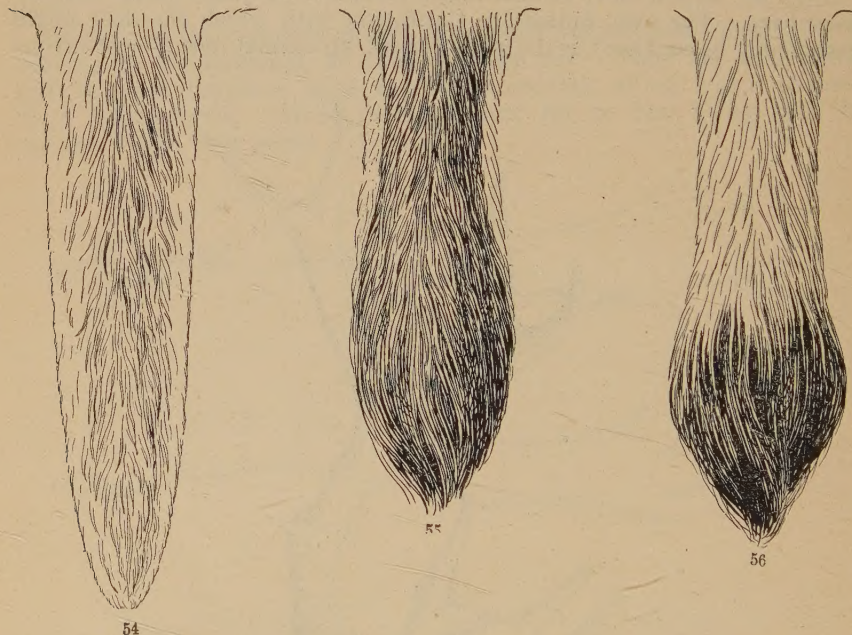
Deer are so generally known that a formal description seems unnecessary here. The only animal in California with which the deer might reasonably be confused, is the wapiti or elk, an animal now almost extinct



FIGS. 52-53. Right antlers, from inside, to show difference between antlers of white-tailed deer and mule deer. 52, white-tailed deer (after Seton, 1909); 53, mule deer (No. 35257, Mus. Vert. Zool.; Mitchell Spring, Modoc County, California). The antlers of the black-tailed deer are of the same general, evenly branching type, as are those of the mule deer.

in the wild state. This member of the deer family may be recognized by its larger size; it usually being two or more times as large as a mule deer. Depending on the sex and the individual, wapiti vary from a little less than four to almost five and one-half feet in height at the shoulder and weigh from 350 to more than 1000 pounds.

In California there are three types of deer, the mule deer, the black-tailed deer and the white-tailed deer. The latter, the range of which is not shown on the distribution map, occurs in winter and only infrequently in northwestern California. Pacific buck, granite buck, prong buck and chemise deer are names commonly applied to young animals of the black-tailed or mule deer by some persons in the erroneous belief that the names denote species different from the black-tailed or mule deer.



FIGS. 54-56. Tails of three species of deer (modified from Stephens, *California Mammals*, 1906). 54, white-tailed deer; 55, black-tailed deer; 56, mule deer.

KEY TO THE SPECIES OF DEER IN CALIFORNIA.

- A. Tail black (see Figs. 55 and 56); antlers branching dichotomously (see Fig. 53); metatarsal gland more than one inch long; bounds when frightened.
 - a. Metatarsal gland more than $3\frac{1}{2}$ inches long (see Fig. 49); only tip of tail black (see Fig. 56); ears large.-----
Mule Deer—*Odocoileus hemionus*.
 - b. Metatarsal gland less than $3\frac{1}{2}$ inches long (see Fig. 50); tip and median dorsal stripe on tail black (see Fig. 55); ears medium.-----
Black-tailed Deer—*Odocoileus columbianus*.
- B. Tail not black (see Fig. 54); antlers with one main shaft and minor prongs branching off therefrom (see Fig. 52); metatarsal gland usually less than one inch long (see Fig. 51); runs rather than bounds when frightened.-----
White-tailed Deer—*Odocoileus virginianus*.

DESCRIPTION OF SPECIES.

White-tailed Deer.

Odocoileus virginianus.

Characters.—Metatarsal gland about one inch long; antler with one main shaft and minor prongs branching off from it; hair coat reddish or yellowish brown in summer and gray in winter; tail relatively long and broad and largely white.

Range in California.—This species occurs only rarely in the eastern part of the Modoc region. It has been found only in winter and apparently does not breed in the state. (Range not shown on distribution map.)

Remarks.—The particular subspecies occurring in California is *Odocoileus virginianus macrourus*. The range of the species is more extensive than that of any other of our deer. It occurs throughout the eastern and southern states, throughout southern Canada except in western British Columbia, and in a considerable part of every western state except Nevada, Utah and California. It occasionally occurs in these three states. In the middle western states, the white-tailed deer has been largely exterminated. Two specimens have been taken in

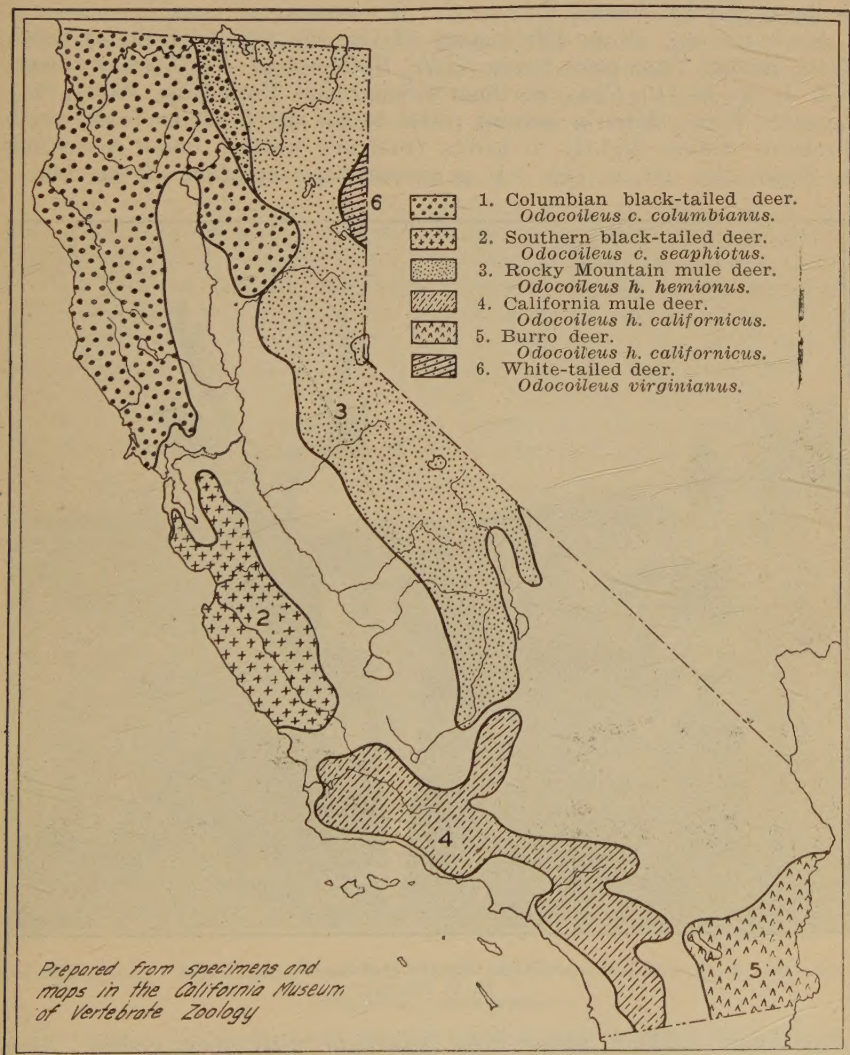


FIG. 57. Map showing distribution of various species of deer found in California.

recent years in eastern Lassen County, one forming the first authentic record for the state.

Hunters have suggested that the name whitetail is unfortunate. Most deer when startled, elevate the tail and thus display only the underside which is white; accordingly, the mule and black-tailed deer appear to have white tails. The name, however, is descriptive since the upper side (see Figs 54, 55, 56) is white, relative to the same parts of the two other species.

Habits.—This species has lost much territory in the east and middle west, but has gained some in the west and north. This is explained by the fact that the white-tailed deer can and does thrive in regions where the land is partly cultivated. In the northern and western part of its range, cultivation of part of the land seems to have created conditions favorable for the species. At least there is good evidence that it has followed the settlements.

Some account of the life history of the white-tailed deer, as taken from Ernest Thompson Seton (*Life Histories of Northern Animals*, Vol. 1, pp. 68-113, Chas. Scribner's Sons, New York City, 1909), may be given here. Seton's account refers to the northeastern form which probably differs slightly in habits from our western one. According to Seton (*loc. cit.* p. 76), "It is essentially a creature of the denser



FIG. 58. A black-tailed deer at the former Hayward Game Farm. Photograph by H. C. Bryant.

woods and thickets where these alternate with open glades. Bare plains and rugged hillsides are an abomination unto it; but every Western river whose long flood-flat is belted and patched with far-reaching scrubby thicket is sure to carry with it a long-drawn-out population of skulking Whitetails, which, between scrub and bog, are able to hold their own and multiply, in spite of rifle and Wolf; while the hill-frequenting Blacktail is rapidly passing away.

"In the hard-wood ranges of the East, this preference is less observable because all of the country is one thicket, but the life of the animal is

the same, and its chosen resort is the borderland between sunny open and friendly cover."

The white-tailed deer does not bound, as do the mule deer and black-tailed deer, but is now and then credited with making high jumps, probably for the purpose of better observing its surroundings. The white-tailed deer is said to be a good swimmer and to be able to make a canoeman race to overtake it. Accounts have been published of white-tailed deer that voluntarily took to the water and some, when hard pushed by enemies, have struck out boldly into the open sea. "They are indeed, so confident of their swimming powers that they invariably make for the water when hunted to extremity." (Seton, *loc. cit.* p. 93.)

During the mating season the bucks are reported to make wallows. In these holes, called *soiling pits*, in which water collects, a buck rolls and grovels much as a hog would do and plentifully besmears himself with mud. What pleasure or purpose there is in so doing is not known.

It is believed that but one fawn is born to the doe in the season she first gives birth to young. After this the number is usually two. There are numerous cases where three and, in one case, four embryos have been found in large does. The fawns are said to weigh about four and one-half pounds at the time of birth. Sufficient information is not available to indicate many points of difference between details of their lives and those of the mule deer fawns described later.

Seton (*loc. cit.* pp. 112-113) has this to say of the white-tailed deer:

There is no probability that the Whitetail will ever serve man in any domestic capacity, but it will always have a value by reason of its singular adaptability and gifts. It is the only one of our Deer that can live contentedly and unsuspectedly in a hundred acres of thicket. It is the only one that can sit unconcernedly all day long while factory whistles and bells are sounding around it, and yet distinguish at once the sinister twig-snap that tells of some prowling foe, as far away, perhaps, as the other noises. It is the only one that, hearing a hostile footfall, will sneak around to wind the cause, study its trail, and then glide, cat-like, through the brush to a further haven, without even trying to see the foe who thus gets no chance for a shot. * * * It is the only one that has added to its range; that, in the North and West, has actually accompanied the settler into the woods; that has followed afar into newly open parts of New England and Canada; * * * and that can hold its own on the frontier.

In spite of this ability to extend its range and succeed in cultivated districts it is not likely that the white-tailed deer ever will be more than an occasional winter visitor within the boundaries of California.

BLACK-TAILED DEER.

Odocoileus columbianus.

Characters.—Metatarsal gland about two inches long; antlers branching dichotomously; hair coat reddish in summer and gray in winter; tail black and relatively broad.

Range in California.—San Luis Obispo County, northward in the coast range to the Oregon line, and along western slope of Sierra at least as far south as Nevada County. See distribution map, p. 239.

Remarks.—The black-tailed deer occurs in the humid coastal belt from Alaska south to about Point Concepcion in California. Its range, then, is seen to be more restricted than that of the mule deer or white-tailed deer. The typical race (*Odocoileus columbianus columbianus*), the Columbian black-tailed deer, occurs as far south as the San Francisco Bay region. The southern black-tailed deer (*Odocoileus columbianus scaphiotus*) which occurs south of the San Francisco Bay region has

larger ears and is paler colored. The cranial differences, which furnish the most constant and reliable characters, are not here mentioned for any of the subspecies.

Habits.—(By Dr. H. C. Bryant.) The Columbian black-tailed deer is a smaller, sleeker and more graceful animal than the mule deer. T. S. Van Dyke has suggested that it bears much the same relation to the larger animal that a thoroughbred Jersey bears to a Durham. This difference in general appearance is of course most noticeable when a close view is possible. In the open, these two species look and act much the same to an inexperienced observer.

The average blacktail seldom weighs more than 125 pounds dressed, sometimes a forked horn weighs around 50 pounds. The length of a buck is not usually more than five feet with a girth of about three feet at the shoulders. The mature black-tailed deer usually has fewer points than the mule deer. Frequently, indeed, large deer carry forked horns only. The antlers of a blacktail kept in captivity in Mendocino County possessed three points at eight years of age and four points on one side at nine years. The spread is sometimes as much as two feet. A fine head is more seldom obtained from this smaller species.

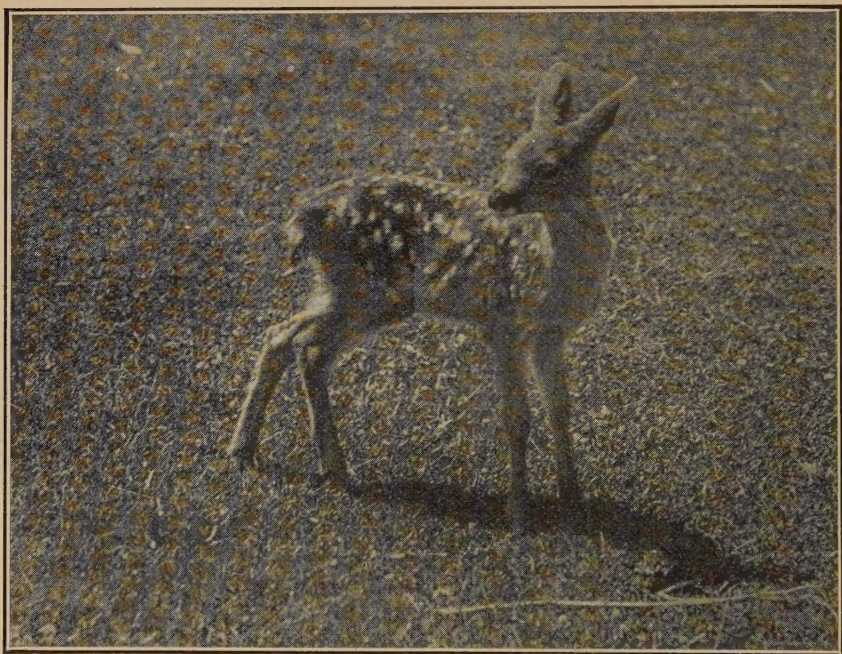


FIG. 59. Fawn of black-tailed deer at the former Hayward Game Farm. Photograph by H. C. Bryant.

The black-tailed deer is largely an animal of thick brush or thick forest. Seldom is a blacktail to be seen moving about in the heat of the day. It feeds almost entirely at night and seems to prefer moonlight nights. One may traverse considerable sections of the coast range without seeing a single deer and yet "sign" may be sufficient to show that deer are numerous in the vicinity. A black-tailed deer oftentimes gives up its feeding very early in the morning, even before sunrise, and lies down in the thick brush.

The brush belt furnishes plenty of tender leaves and twigs, and this forms the main food supply. As with other deer, grass is seldom touched. Leaves and twigs of salal, huckleberry, wild lilac and other shrubs are taken. In some places acorns form an attraction.

This deer has a keen sense of smell and many a hunter is amazed at the ability displayed in detecting his presence. As with other deer, this species will stand considerable noise, but quickly detects motion or human odor. The blacktail makes good use of its favorite hiding places in the brush, for it hides and sulks, often-

times allowing one to pass at close range without attempting to run. Undoubtedly it feels more safe in thick brush even at close range than in open country.

As the rutting season comes on, the necks of the males swell and they become very pugnacious. The rutting season varies in different parts of the state beginning earliest, in the latter part of August, just north of San Francisco Bay. In the extreme northern part of its range, bucks with swollen necks are not noticeable until about the first of November.

Fawns, two in number as a rule, are generally born between April and July, but sometimes much later. The coloration of the fawn is reddish brown with distinct whitish spots. The spotting is lost in the fall with the growth of the hair.



FIG. 59. Black-tailed deer shedding the velvet at the former Hayward State Game Farm. Photograph by W. N. Dirks.

MULE DEER.

Odocoileus hemionus.

Characters.—Metatarsal gland about five inches long; antlers branching dichotomously; hair coat rusty red in summer, grayish brown in winter; tail whitish with black tip; ears very large.

Range in California.—Throughout Sierra range and mountains of southern California. See distribution map, p. 239.

Remarks.—The different subspecies (geographic races) of this species have not been studied critically in recent years and the ranges shown on the accompanying map are therefore provisional. The various species of deer, however, are better



FIG. 61. Mule-tailed buck, Yosemite National Park. Photograph by Mrs. J. Knowles.

known and their ranges as shown on the accompanying map are determined with considerable accuracy. The typical form, occurring in the Sierra, the Rocky Mountain mule deer (*Odocoileus hemionus hemionus*), has a wide range outside as well as inside the State of California. Some hunters believe that the extra large individuals in Modoc County, some of which are said to weigh, after dressing, more than 300 pounds, form a distinct variety. This has not been proved. Except for the size there are few tangible differences. The California mule deer (*Odocoileus hemionus californicus*) has a more restricted range and outside of California occurs only in Baja California. This form is characterized by its more reddish coat, less extensive white rump-patch and greater extent of black on the tail. In fact the statement made in the key above, that only the tip of the tail is black, hardly applies to this subspecies for the black may be rather extensive on the tail. However, the long metatarsal gland seems to distinguish this race of the mule deer from the black-tailed deer. The third subspecies of mule deer known to inhabit California is the burro deer (*Odocoileus hemionus eremicus*). Its range, as shown on the distribution map, is in the desert region of southeastern California and, in common with other animals of this region, it is remarkable for its extremely pallid type of coloration. This is a large deer and the beams of the antlers, before branching, are relatively long. The tail is black on the tip only. By persons who have been so fortunate as to see this deer in the wild, it is said to be readily distinguishable from the other two races of mule deer in California. It is now rare in the state and no longer exists at many places where it was found fifty years ago.

The shape of the mule deer's tail varies much with wear. In adult animals the most distally located white hairs on the tail become broken and worn more than the tougher, terminal black hairs, thus leaving a tail with a bushy, black brush, a thin middle part and a wide base. In an unworn state, the outline of the tail is more symmetrical and it is only slightly constricted near the middle.

In northern California where the range of the mule deer overlaps that of the black-tailed deer, an occasional hybrid is found. One of these seen had the black of the tail-tip extending a short way up the middle of the upper side of the tail. The metatarsal glands also were intermediate in length between those of the mule deer and black-tailed deer. These hybrids, it should be understood, are rare and are the exception rather than the rule where the two species occur in the same territory.

Habits.—Within the range of a single species the habits of animals at one place may differ slightly from those of animals at another place. Thus it should be remembered that the following remarks on the life history of the mule deer are, unless otherwise stated, based on experience with the mule deer in Arizona* where *large numbers of deer* were present and where *food was scarce*.

The mule deer is an inhabitant of the more arid parts of North America. It does not occur in the humid coast belt of California or in the humid coastal part of the territory to the north of this state. Reference to the distribution map (p. 239), shows that the range of this species extends to the coast only in southern California, where, unlike farther north, the coastal region is comparatively arid.

In most parts of California the mule deer have separate summer and winter ranges. In spring, as the snow melts, the deer work up into the mountains and higher areas where they remain until fall. With the first heavy snowfall they migrate down to their winter range, the region, in northern California, covered by juniper and chaparral. Most of the mule deer, in this part of California, migrate down the eastern slope of the Sierra.

Little data on the range of individual deer are available. Bryant (*Journal of Mammalogy*, Vol. 5, No. 3, p. 201, 1924) states that the greatest known distance between points visited by a certain mule deer

*The author is indebted to the United States Bureau of Biological Survey under whose auspices the study of deer in Arizona was made in 1925, for the privilege of using this information.

doe, that had been marked by a metal bell strapped on its neck, was seventeen miles. Records of occurrence of this deer were obtained both on the summer and winter ranges. Certainly the distance between the summer and winter ranges of many mule deer is greater than this, but in some cases it probably is less. From repeated observation of the same individuals of mule deer in Arizona, recognizable by reason of peculiarities of structure, the writer concluded that within the period of observation, June 7 to July 28, 1925, few deer wandered over an area of more than two square miles.

On the winter range the animals sometimes congregate in large herds, but in California the mule deer usually are found singly or in small bunches. On the summer range, in some parts of Arizona where the writer has studied this species, there is an uneven distribution of deer. Does with fawns usually remain within two miles of water. The bucks, barren does and yearlings are more evenly distributed and may occur far from water. In the Sierra of California water is to be found every few miles and there is a correspondingly more even distribution of the deer here than in regions where watering places are long distances apart.

In their migrations to and from the winter range deer often use the same route year after year. This is especially true in rugged country where only occasional canyons cut through high, sheer cliffs that separate the summer and winter ranges. These canyons are utilized as migration routes and in fall, after the first heavy snow, literally hundreds of deer may pass a given point in such a canyon within a few hours. This "pass migration" is well known to hunters and in northern California many deer (more black-tailed than mule deer) are killed by persons who camp along these routes and wait until the migration takes place. There are places surrounded by escarpments so high that deer seldom are able to surmount the cliffs and thus do not occupy the otherwise suitable areas of summer range.

Among the factors that determine the distribution of mule deer, humidity, water to drink and high escarpments have been mentioned. Temperature and amount of snowfall are two factors concerned in causing the seasonal migration of deer and the former probably, at least indirectly by its effect on plant growth, is a factor in determining the geographical range of the species.

The actual number of deer in a given area is extremely hard to determine. In the areas in California where deer had to be killed to control the hoof and mouth disease, fully three times as many were killed as formerly were thought to exist in these areas. Many of those killed probably drifted into the depleted areas from the surrounding territory, but allowing for these, the number killed far exceeded the estimates previously made of the number that existed there.

Some attempt was made for several years to determine the number of deer killed in California. The reported kills for six consecutive years from 1911 to 1916 were as follows: 6489, 7537, 8269, 8699, 8343, 8072.

The reports were not compulsory and it is estimated by officials of the Fish and Game Commission that 12,000 were killed each year. A new tag system has been put in force, and definite figures of the number killed each year will be available hereafter.

The weights of some mule deer taken in Modoc County probably have been over estimated, but there is dependable data to show that mule deer of this region do attain large size. A buck taken in the lava beds by L. G. Renshaw in 1924, after hide, head, feet and entrails were removed, weighed 270 pounds, this being verified by Wm. S. Brown of the Forest Service (CALIFORNIA FISH AND GAME, Vol. 11, p. 30). Two specimens taken in the Granite Mountains of Nevada about September 1, 1908, were weighed carefully by F. P. Cady with a pair of steelyards, after entrails and feet had been removed. One weighed 217 pounds and the other 220 pounds (CALIFORNIA FISH AND GAME, Vol. 5, p. 205). A Modoc County five point dressed buck, said off hand to weigh 225 pounds, when actually weighed by Jay Bruce, state lion hunter, tipped the scales at 190 pounds. Mr. Bruce has found the larger mule deer bucks in the central Sierra region to weigh about 165 pounds dressed. One taken in the San Jacinto Mountains of southern California weighed 160 pounds. (H. C. Bryant, MS.)

At present man unquestionably is the prime factor in controlling the number of deer. He may reduce their number directly by hunting or indirectly by utilizing their range for purposes of agriculture, thereby destroying the environment essential to the deer's existence. On the other hand man may cause the number of deer to increase by destroying their natural enemies, by maintaining favorable conditions of forage and shelter and safe breeding places and by prohibiting or limiting hunting.

In California earnest effort is being made to maintain the present number of deer, and, in regions where they have become scarce, effort is being made to increase the number. The California Fish and Game Commission is charged with this work. One of the most effective means employed by this Commission to accomplish its task is the establishment of game refuges in various parts of the state. In these, deer find shelter and safe breeding places. Since no hunting, other than that of mountain lions and other natural enemies of the deer, is permitted on these refuges, they function as centers of dispersal from which the excess of the deer population spreads to the surrounding territory. Also, at no place in the state can deer be killed except during a limited period of six weeks in the fall and then but two bucks (one only of Modoc mule deer) are allowed each hunter.

Thus active means now are being employed to preserve the deer. In the main these efforts are successful but much study remains to be made of deer before the most effective conservation and utilization of them is possible. For example, the extent to which grazing by domestic stock can be permitted in the areas inhabited by deer without decreasing the number of deer remains to be determined. On this and similar problems the California Fish and Game Commission is gathering information and in time will be able to improve the now generally effective measures that aim to insure for future generations a sizable native deer population in the state.

Foremost among the deer's natural enemies, excepting man, are mountain lions. In fact mountain lions seldom occur where deer are not found and it is established that deer are the principal food of this carnivore. The mountain lion's method of attack, in general, like that of other cats, is silently to stalk the prey until close upon it, and then with one or a few swift bounds to spring out upon the unsuspecting

animal. Control of lions is maintained through a bounty system and the employment of a state lion hunter (See: Bruce, Jay. "The Problem of Mountain Lion Control in California." CALIFORNIA FISH AND GAME, Vol. 11, pp. 1-17).

Although destruction of deer by the above mentioned predators might, at first thought, appear to be without benefit, there is this to be considered: that in selecting the weaklings and diseased the species may be improved. It is conceivable that a given animal affected by some contagious disease might sooner be eliminated if predatory mammals were present than if they were not. As a result, the disease would be less quickly and less widely spread. However questionable the benefits in a particular case of this kind might be, certainly, benefits would be derived from a continual elimination of the unfit and the diseased of all kinds. Obviously, only the stronger, healthier, that is, the more virile, animals would be left to reproduce their kind and to perpetuate the species.

Coyotes destroy numerous deer. Fawns, yearlings and weaklings are particularly liable to attack, but full grown, healthy bucks seldom are killed. In one case known to the writer a single coyote ran down and killed a yearling doe, but several coyotes frequently unite in the chase. Occasionally one lies in wait until the deer is close by, whereupon it secures the prey by a quick rush. Nearly always the deer is dragged down and killed by bites in the throat and lower neck. It should be remembered that in many places where deer are found, coyotes feed largely and sometimes altogether on rodents and occasionally partly on insects. Also coyotes occur abundantly in regions where deer are not found. However, in some places, as for example in Trinity County, coyotes are destructive to deer, particularly in winter when snow covers the ground.

Bobcats are known to kill deer, especially fawns. Mr. Jay Bruce reported that in January, 1916, a fawn was killed near Wawona in deep snow lightly crusted. The tracks were followed and two bobcats were killed. Accounts have also been published of deer being killed by bears, wolverines, fishers and bald eagles.

Deer harbor several parasites. A fly larva frequently infects the nasal region. Ticks are not infrequently found in the ears and on other parts of the deer. A louse peculiar to deer, and at least two kinds of fleas are included among the external parasites. Several species of blood-sucking dipterous insects annoy deer. One species, commonly known as the deer fly, swarms about the deer both while they are on the move and when lying down. However, the deer is well equipped to meet the attacks of this and similar pests for the cutaneous maximus muscle, whose function it is to shake the skin, is well developed and extends back to the area that can be brushed free of flies by the tail. Deer that have been lying down often run a little way after getting up, presumably, in order to rid themselves of these flies. Deer are subject also to pink-eye and some that were temporarily blinded by the disease have been known to fall over cliffs and kill themselves in this way. Tumors are sometimes found on the necks of deer and, in at least some cases, prove fatal. Liver flukes and several other parasitic worms are often found in deer. The list of natural enemies and diseases doubtless could be greatly extended with more study, for deer are known to be subject to certain diseases of cattle and horses, at least

diseases of the same general nature, for example, the hoof and mouth disease and distemper; and they probably have others not known in domestic stock.

Serious outbreaks of disease among deer have occurred in California. One such was the epidemic that appeared in the southern part of Trinity County in the summer of 1911 and that spread from there to southern Humboldt, northern Mendocino, northern Lake and western Tehama counties. Although the exact cause of the disease never was definitely determined, there is some evidence indicating that it was a bladder worm infestation. It was believed, on good evidence, that 5000 deer died in Trinity County alone from the disease. In this case the black-tailed deer was the one affected. At least twice since, smaller outbreaks of similar nature have been reported from these northwestern coast counties. Many deer died in Modoc County in 1925 from a disease that never was well understood. The most destructive recorded outbreak of disease occurring among deer in California was that of the hoof and mouth disease. This disease spread from cattle to deer in 1924 and although few deer succumbed to the disease before it was stamped out, many thousands of deer were killed as a necessary part of the eradication methods employed.



FIG. 62. Mule-tailed deer at salt log, Lassen National Forest. Photograph courtesy of the United States Forest Service.

Deer are, of course, subject to accident. One way in which many are killed annually is by getting one or both hind legs caught in wire fences over which they attempt to jump. Fawns have been found dead with a leg caught between two parallel limbs. The mule deer's habit of jumping over limbs, logs and other obstacles that it happens to encounter probably renders it more liable to accidents of this kind than are most other animals. In the case of wire fences, however, mule deer, unless frightened, attempt to go under or through, rather

than over the same. Oftentimes, too, deer are snagged on branches and stubs. Hunters have taken specimens in which parts of sharp pointed branches, as much as eight inches long, were found. In some cases the flesh had completely grown around these and the deer was seemingly not greatly inconvenienced by them.

Accounts of early explorers and naturalists indicate that mule deer formerly were often found in large herds. However, a few years of hunting are said to have resulted in breaking them up and large herds now are found in but few places. In 1923, on the VT Park (local expression for De Mottee Park, U. S. G. S. Kaibab Quadrangle Sheet, 1886) meadows of the Kaibab Plateau, in Arizona, observers counted, in one evening, more than 1000 deer. Studies indicate, however, that the congregation into herds at this place is not so much the result of gregarious instincts as it is of the localization of a favorite forage plant, a species of native clover. Perhaps some of the huge herds observed in the early part of the nineteenth century also are to be explained on this basis. However this may be, mule deer are gregarious to a degree and, in places where they are not hunted diligently, do congregate in herds. This is said to be especially true on the winter range. It is also true on the summer range. It may be pointed out that, until the past two years, no hunting has been allowed on the Kaibab Plateau for a long period and that the deer are, or at least were two years ago, in a more natural state than in most parts of their range. Here herds of five to twenty deer were common in July. Sometimes these herds were composed entirely of bucks, again they were made up of barren does and yearlings and occasionally, but not often, of bucks with yearling and barren does. In certain herds of bucks the same individuals associated together for several weeks. They not only grazed as a herd but bedded down together and in all respects acted as a permanent association of individuals. Does with fawns, however, and many other deer, in fact most of them, associated with one another, if at all, only when feeding.

The pugnacity of bucks during the mating season is well known. Although the fights at this time are most strenuous ones, fatalities apparently are rare. Occasionally, however, the antlers become interlocked in such a way that the combatants can not draw apart and then the death of both animals ensues. Probably any earnest combat in summer or early fall, at which time the antlers are in the velvet and have soft tips, would be decidedly painful. The bucks are more sociable in late summer and seldom manifest hostility toward one another. In an observed instance, at this time of year, one buck, while lying down and chewing his cud, was seen resting his head on the flank of another buck lying beside him.

Sometimes the older bucks see fit to make threatening rushes at young bucks or does when the latter are feeding on some choice spot desired by the former, but earnest combats seldom are, if ever, indulged in. At this time of year, however, the does are shorter tempered than the bucks and do engage in serious combat. In one fight seen, each participant began by lowering the neck to a horizontal position, straightening the head out on a line with the neck, and laying back the ears. The two then, always keeping face to face, with noses about two feet apart, circled about until finally they reared up on their hind legs and struck viciously at one another with the forefeet, the only weapons

employed. After rearing up for the third time one secured the advantage, and when its adversary fled, pursued it and administered a couple more sharp blows on the rump.

The mule deer are not the timid creatures that deer in general are sometimes thought to be. They are cautious rather than timid. In most cases, unless *convinced* that there is danger, they choose to remain and investigate rather than flee at the first alarm. Their habit of stopping for a "last look" after first being startled is well known to hunters. Several times, deer, whose suspicions were aroused by my presence in the vicinity, spent as many as twenty minutes in watching me while I lay motionless. When attempting to satisfy their curiosity in cases of this kind they usually move about and observe the object of interest from several points of view. In so doing they never were seen to approach closer than to within twenty feet of the thing being investigated. Although extremely curious, they convey the impression that they also are extremely cautious. This manner of behavior would appear to be of no little advantage to the deer if their suspicions were aroused by an at first unrecognized object that should prove to be a mountain lion.

Usually mule deer require much visual inspection of a still object to determine its nature, although, like man and many other animals, they are quick to note any movement. Their sense of hearing, however, unquestionably is keen. A slight sound barely audible to the human ear at a distance of five feet usually will be detected by a deer at a distance of from twenty to thirty feet. Their sense of smell likewise is keen. Several times deer "up wind" that I was watching changed their position to "down wind," whereupon they immediately detected my presence. It often happens, too, that deer become suspicious of an observer and look directly and intently at him, but satisfy themselves concerning his identity only after taking a position "down wind" from where they get his scent.

In addition to detecting danger directly through their own senses deer become aware of danger through the actions of their fellows. Let one deer manifest curiosity in a given object and it is not long before all the deer within a radius of 100 yards of the first also approach to investigate. When unusually concerned about something of which they are suspicious the deer sometimes snort. Both does and bucks do this. The snort is accompanied by a quick toss of the head and sometimes by a stamping of the forefeet. This behavior is certain to attract any other deer that are nearby, who often come on a trot. Other than the snorting and stamping, no noise or action that could be interpreted as a means of signaling to one another has been noted by the author. Indeed the only vocal sound from adult deer the writer ever has heard is the bleat of wounded deer. Other observers, however, have reported additional vocal sounds for adult mule deer.

When bounding the mule deer apparently strikes the ground with all four feet simultaneously. The impact is considerable, for it can be heard a long distance. This bounding gait is almost invariably adopted when the animal becomes frightened and flees from suspected danger. It is used in going both up and down hill as well as on level ground. The animal not only clears a long horizontal distance at each bound but rises vertically to quite a height. Seton (*loc. cit.* p. 140) found that the distance between tracks of running mule deer sometimes was as

much as 25 feet and the writer once measured a fence six feet high over which deer jumped with several inches clearance. A gait of this type would appear to be of economy to the forest-dwelling mule deer whose path is strewn with fallen logs, branches and bushes which it must pass over.

Although the bounding gait is resorted to when the deer first are frightened it is also used at other times. Deer even when not frightened many times change their gait from a trot to a bound, as for example, when entering open parks to feed. It is interesting, too, that fawns less than a week old sometimes bound when startled.

The mule deer can make rapid time by trotting. On rare occasions, when badly frightened, they change the bounding gait to a running one similar to that of the white-tailed deer. When in this gait the head is held low and the speed attained is believed to be greater than when they bound. When walking about unfrightened, a deer holds its head lower than when running, bounding or trotting. However, when one becomes suspicious of something the head is held well up and the feet are alternately lifted slowly and then let down with a quick jerk. Such an attitude indicates that the deer is on the verge of bounding away.

The mule deer is not as long winded as, for instance, an antelope. After running half a mile, or sometimes a shorter distance, a deer pants heavily. Nevertheless, its bounding gait seems better adapted to the brushy, broken country that usually is its habitat than are the gaits of its enemies, and this generally makes the mule deer the winner in any race for its life.

During June and July, at least, mule deer usually lie down between the hours of 8 a.m. and 4 p.m. When in herds at this time of day the bedding ground is in the open timber and so located that anything approaching it can be seen at some distance. However, when resting singly, the places chosen are usually the most concealed ones to be found, except in the case of does that have young fawns, which choose locations that allow them to see the places where their fawns are concealed. Fir thickets or thick clumps of spruce are favorite places for the deer to bed down in. A bed is sometimes used by the same individual deer on several consecutive days. In nearly every case these concealed beds permit exit and entrance from two sides and are in deep shade. Some are as much as a foot and a half deep and probably are used for several summers. The beds of single deer and those of herds usually are made on thick carpets of deciduous leaves or evergreen needles.

In California, mating begins in November and extends into December. The bucks with enlarged neck glands become nervous, belligerent and restless. Nose to the ground they are said to often trail does for miles. Like other deer, the mule deer is polygamous. The period of gestation is about six and one-half or seven months.

On the Kaibab Plateau of Arizona the fawning season in 1924 reached its height in the last week of June and the first week of July. Fawns were born as early as June 15 and as late as July 25 and therefore varied as much as forty-one days in age. Seven pairs of twins were recorded among 234 fawns captured by parties engaged in rearing them in captivity. The writer saw only two pairs of twins in the field and the two pregnant does examined contained but one embryo

each. Combined data indicate that the ratio of twin to single fawns was one to fourteen. This is believed to be a lower ratio than usually exists and both it and the late fawning season probably are explained by the shortage of food at this place. The deer were in poor physical condition and this apparently directly reduced the number of young born to each doe. Local residents stated that the rutting period occurred later the previous fall than was usually the case when the deer were in better physical condition. In California, and in many other parts of the mule deer's range, twins appear to be more common than single fawns, and triplets are occasional.

Fawns vary greatly in size at the time of birth. One that was less than two hours old measured as follows: total length 570 mm. (22.441 in.); length of tail, 65 mm. (2.559 in.); length of hind foot, 240 mm. (9.449 in.); length of ear from notch, 110 mm. (4.331 in.). The corresponding measurements of an embryo ready for birth were 710 mm. (2.329 ft.); 110 mm. (4.331 in.); 280 mm. (11.024 in.); and 120 mm. (4.724 in.).

Some idea of the rate of growth may be had by comparing the following measurements with those of the same fawn when less than two hours old. On June 25, when 27 days old, this fawn measured: 700 mm. (2.296 ft.); 70 mm. (2.756 in.); 285 mm. (11.220 in.); and 120 mm. (4.724 in.). Thus in less than a month the increase was 130 mm. (5.118 in.) in total length; 5 mm. (0.020 in.) in length of tail, 40 mm. (1.575 in.) in length of hind foot and nearly 10 mm. (0.394 in.) in length of ear. Because this fawn was in captivity it may not have grown as fast as it would have in the wild. However, it apparently was in good health.

With all, the young fawn is a curiously proportioned, yet handsome, animal. Although the ears and legs are disproportionately long they are delicately formed and are used in anything but an awkward manner. The numerous, irregularly arranged white spots set on a brown ground color form a delicate color pattern quite in harmony with the fawn's graceful movements and generally charming yet sprightly appearance. The color varies quite as much in animals of the same age as does the size. The arrangement of the white spots is hardly the same in any two cases and the ground color varies from light yellowish brown to almost pure black. These differences are individual ones and are not correlated with sex as the writer suspected before carefully looking into the matter.

The does bearing fawns concentrate in areas near water and drink at least once and usually twice each 24 hours. In the first week of July, at which time it rained daily on the Kaibab, does with fawns were found as far as five miles from any lake or spring, but before and after this rainy period none were found farther than two miles from a source of water supply. At this place in Arizona where the summer range included the yellow pine belt and the higher fir belt more fawns per square mile were found in the first mentioned belt. An understanding of the does' fawning habits explains this. In both types of forest the fawns are born, and, while small, live in a definite type of habitat. The place chosen by a doe is, almost without exception, a high point of land or ridge at the junction of two canyons or where a canyon curves, thus partly encircling a piece of high land. Furthermore, the timber must be relatively open. The latter condition exists

on practically all points of the type mentioned above in the yellow pine belt, but in the spruce and fir belt some points are covered with a far denser growth of timber than are others. On the more thickly timbered points no fawns are found, while on other points in the fir zone, that differ only in being less densely covered with timber, many fawns are found. The doe's need of detecting approaching enemies probably is one factor in determining the choice of these points of high land covered by open timber as fawning grounds.

Until they are five weeks old the fawns remain hidden most of the time. Some were found, less than one hour old, lying in the open, but older ones than this commonly lie beside a log, in a tangle of fallen limbs or under a bush. In situations of this kind they are relatively inconspicuous for they lie flat on the ground and their spotted coats harmonize with a variety of backgrounds. The neck is held straight out or slightly curved and the large ears are tightly folded against it. The hind legs are doubled forward under the belly, thus permitting the fawn to bound up and away at an instant's notice. However, they often allow one to come to within a few feet of them and do not move, but the older the fawn the more apt it is to flee when approached. After leaping up and when only a few feet from its hiding place, one very young one dropped flat on the ground when a hat was thrown at it, and others did the same thing after running a hundred yards or so from dogs that pursued them. The instinctive reaction of a very young fawn to sudden danger is to drop flat on the ground and lie motionless. The survival value of this behavior, after the fawn has once started to run from an enemy, is hard to understand. On the other hand, it is easy to understand how, when they lie still and do not run at all, they escape many enemies, that otherwise surely would find and destroy them. If the young fawns possess no scent, the apparent value of this instinct to lie motionless is considerable. The commonly held belief that fawns have no scent is apparently well founded. The characteristic odor of adult deer emanates largely from the metatarsal glands. Although when the fawn is born these glands are readily recognizable due to the thick, long, coarse hair that marks their position, they yield no odor as do the same glands on older deer. None of the dogs, including one trailing hound, which the writer watched catching numerous fawns, ever followed them by scent. Probably the scent develops when the fawn is almost six weeks old.

Each doe keeps close watch on her offspring and it is not often that a person can approach the fawn without being detected by its mother. Most of the time she does not remain right with the young fawn, but she seldom is farther than 150 yards from it, except when she goes into some meadow to feed, and even then she does not venture far away for any great length of time. When a person approaches a fawn, the doe often comes a little way toward the intruder and remains within 40 to 75 yards until the fawn bounds away, when she, too, quits the region. At such times, the doe's ability to keep track of her fawn is remarkable and often hard to explain, but in numerous observed instances, she always came back to very near the place where the fawn had hidden itself.

A digression to point out certain facts about lost fawns seems permissible here. It happens every year in the Sierra that kind-hearted

people find and bring home to feed on a bottle "lost fawns." Incidentally, most of these fawns soon die at the hands of their would-be benefactors. The facts are that nine out of every ten "lost fawns" are not lost at all. Very young fawns are lank, ungainly creatures and do suggest a starved animal. Also, young fawns, like lambs, sometimes follow a person who chances to pass close to them on horseback, or even on foot. Thus, many persons are led to mistake properly cared for fawns for lost ones and out of pity to take them home to rear by hand when all the while the doe was anxiously watching the kidnappers from some concealed vantage point.

The does are capable of defending, and do defend, their fawns from some formidable enemies. An instance was once reported to the author, by Bob Vaughn, of a doe chasing a coyote, probably away from her fawn, and the coyote was said to have been doing its utmost to absent itself from the general vicinity and especially from the particular vicinity of the sharp hoofs on the doe's forefeet. Seton (*loc. cit.* p. 129) has reported a similar instance. Parties on the Kaibab engaged in catching fawns stressed the necessity of keeping near the dogs during the chase after a fawn, because of the fact that the doe would almost invariably run between the dogs and the fawn, when the former were not closely accompanied by man, and, by using her forefeet as weapons, would completely rout the dogs and thus allow the fawn to escape. Any other deer that were near a fawn being pursued, generally took equal parts with the doe to which the fawn belonged in fighting off the dogs. It is interesting that bucks as well as does did this. Although dogs of various kinds and sizes were used for pursuing and capturing fawns, none of them were able to cope with adult deer bent on defending a fawn unless man intervened.

Probably because of their maternal instincts, does that have young fawns are more alert for enemies than are other deer. When one deer indicates by its behavior the presence of suspected danger, does that have fawns in the vicinity are the first to investigate and the boldest in approaching the cause of alarm. They differ from the other deer also in that when the object of suspicion proves to be a real danger they bound only a short distance away and then stop at some place commanding a view of the intruder, whereas the other deer bound away far out of the danger zone.

When a doe, accompanied by her fawn, sights danger the fawn evidently recognizes the slow, deliberate, tense movement of its mother as the signal to hide, and this it does by dropping beside the nearest log or bush or often on the bare ground where it chanced to be standing. Other than the above-mentioned movements of the doe, no behavior that could have been the fawn's cue to drop and hide was seen in observed cases. However, a Mr. Price told me of seeing a fawn that dropped the instant the doe it was nursing sighted him and in this case the fawn seemingly received its stimulus through some sense other than sight.

Fawns one or two weeks old nurse twice daily and are found with the does from 7.00 until 10.00 in the morning and from 3.30 until 6.00 in the afternoon. The remainder of the time they lay hidden. Some fawns, only a few days old, were seen nursing as early in the afternoon as 2.00 o'clock and it may be that they nurse oftener than twice a day. Frequently the young are permitted to nurse when the doe is

lying down. When she is standing the young nurse either from behind or from the side, and butt vigorously, much after the manner of a young calf, as though they were not satisfied with the progress they were making. Usually the doe submits to this rough treatment without protest, but sometimes she appears to resent it and throws the hind leg forward or backward each time the fawn tries to nurse, thus preventing it from reaching the bag.

Fawns five or more weeks old accompany their mothers much of the time and enter open parks with them to feed. In large herds, fawns often become lost, or think that they are lost, and bleat long and loudly. This they seldom do when alone with the mother or with only a few adult deer. Although the fawns take but little forage before they are five weeks old, they do take some when no more than two weeks old. However, to fawns of the last mentioned age, browsing apparently is tiresome or at least not attractive, for they spend more of their time when with the doe in gamboling and frolicking about than in doing anything else. For no apparent reason the fawn will of a sudden take off at a rapid rate and then stop as suddenly as it started. Its next run usually carries it back in the direction of the doe at whose side it may stop or by whom it may run at a lively pace. When accompanying the does, fawns of this age seldom run farther than thirty yards from the doe and none were seen to remain away from her for more than two minutes at a time. When a small fawn does elect to forage it does so only when at the side of the doe and with its head near hers. Usually, too, it stands with the body axis parallel with the doe's and the idea that the fawn is imitating the doe is strongly borne in upon the observer's mind. After a nibble or two taken alongside its mother, the fawn soon makes off on one of its reckless dashes. The doe pays but little attention to these antics of the fawn and to judge from the behavior of the two the fawn is more concerned about keeping near the doe than the doe is about keeping near the fawn. Fright of the fawn at something is not taken by the doe to indicate that possible danger is near. For instance, on one occasion, while watching a doe and her fawn the latter came and peered over a log at me and then bounded away in great fright to a position that placed the doe between it and me. The doe, that was at the time only ten feet from me, cast a casual glance in the direction the fawn had taken and continued feeding. This behavior of the doe was in marked contrast to that of a few minutes later when I, while trying to follow the doe and her fawn through the timber, was discovered by another deer. Immediately, the doe came to the side of the other deer and soon discovered me, whereupon my observations of the relations of that doe and fawn to one another were necessarily over for the afternoon.

Mule deer are both nocturnal and diurnal. If to be classed as one or the other, they probably could best be called nocturnal animals, for they seem to be active during more hours of the night than of the day.

The following extract from the writer's report on the deer of the Kaibab Plateau, as observed during June and July of 1924, is pertinent here:

"At VT Park the deer usually become active about 4.30 p.m. After leaving their beds they wander down in the direction of the open park,

but do not enter it until 6.30 p.m. In the meantime they browse in the forest and gather in the edge of the timber about the park. Finally, as the shadows cast by the trees lengthen and creep eastward, a few bold deer venture out and follow these shadows to the clover patches which are located along the middle of the park some 100 to 400 yards distant from the edge of the timber. On dark, cloudy days, the deer enter this and other parks fully one-half hour earlier than on bright, sunshiny days. The presence of a few deer in the park apparently imparts confidence to the others lingering about its margin for soon they bound out and join those already in the open. Deer that may be recognized by individual peculiarities of structure enter the park each evening at the same place and leave it at the same place. Also, their time of coming and going varies little from day to day, except in so far as the cloudiness of a particular day causes them to come out earlier or to remain out longer than on clear days.

"The time of feeding apparently varies with the degree of molestation of the deer, for when the writer first visited the region of VT Park, early in June, some deer came into the park about 4.30 p.m. and nearly all had left by 7.30 in the morning. But later, when tourists arrived and daily attempted to study the deer close up, the bulk of the deer entered the park fully two hours later in the evening and left one hour earlier in the morning. In other parks seldom visited by man the feeding time remained practically the same and as it was in VT Park early in the season. Some deer fed in the park between 1 and 2 a.m. Whether or not these were deer that entered the park before dark and left after sunrise is not known. Probably they were not, for it seems unlikely that a deer would have to graze for twelve consecutive hours to secure the required amount of food."

It must not be inferred from the above that mule deer always feed in open parks, in meadows or in glades, for, like other deer, they are typically browsers, not grazers, and naturally much of their food is taken from various species of shrubs and trees.

When browsing, deer not only reach as high as is possible from a position on all four feet, but often rear up on the hind feet to reach desirable forage. In observed instances, bucks have been seen to rear up and place the forefeet, goatlike, against the trunks of trees and feed on leaves that otherwise would have been out of reach. Other instances were seen where deer were astride limbs which they held down while feeding on them. When released by the deer, some of these limbs sprang back to as high as five feet above the ground; thus, the deer must have reared on their hind feet and used the forefeet to catch and bear down the limbs.

When grazing, that is when eating off the ground, deer sometimes proceed in a straight course and sometimes turn slowly about, using, as it were, the hind feet as a pivot. Since the deer have no incisors above, forage has to be partly pulled or jerked off rather than actually bitten off. A bite of forage is grasped and then secured by a backward jerk of the head. Thus, the nose is jerked backward and, in bucks, the antlers are tilted forward at each bite, imparting thereby a "rocky horse" motion to the head.

Deer eat while lying down. Both bucks and does do this. After reaching out as far as possible over a half circle, the deer generally get up and feed in the usual fashion.

Mule deer do not prefer grasses (*Gramineae*). If watched at close range when grazing they can be seen to eat around the grass clumps and sometimes to drop small bunches of grass that they pull up accidentally with the more desirable plants. It is well established from laboratory analyses of stomach contents that deer feeding in meadows utilize the herbaceous plants and not the grasses. Various grasses are, of course, found in the stomachs of deer, but the percentage of grass is but a small part of the total and most of the grass is taken accidentally.

Little definite data on the food of deer in California are available to the writer. Dr. H. C. Bryant has supplied the following list of plants that he has seen the mule deer eat in the Yosemite region. These plants are:

- Willow (*Salix*, sp.).
- Aspen (*Populus tremuloides*).
- Black cottonwood (*Populus trichocarpa*).
- Oak (*Quercus* sp.).
- Service berry (*Amelanchier alnifolia*).
- Deer brush (*Ceanothus integerrimus*).
- Snow brush (*Ceanothus cordulatus*).
- Evening primrose (*Oenothera hookeri*).
- Manzanita (*Arctostaphylos* sp.).
- Snow berry (*Symphoricarpos albus*).
- Apple (*Malus* sp.).
- Mushrooms.

Of all these the deer brush apparently is the most preferred. Probably other species of *Ceanothus* than the two mentioned above also are eaten. Herbaceous plants in great variety are utilized. The acorns of the oak, as well as the leaves, are sought. Mushrooms furnish an important article of diet at the time they begin to push through the ground. It appears that deer have some means of locating them before they push above ground, for deer often paw away the pine needles in the forest to secure the concealed fungi. Deer are extremely fond of fallen apples, too, and in orchards where this fruit is allowed to lie on the ground, any deer in the near vicinity are almost certain to come and feed on it.

All deer are fond of salt. Mineral springs serve as licks and are an attraction to both sexes in summer. Apparently, deer from a considerable area will make excursions to these natural licks. Salt logs for cattle likewise attract deer in summer months and many a nature photographer has baited deer successfully by using common salt.

Deer oftentimes eat the leaves and twigs of orchard trees, particularly apple trees, in the mountains of California. The damage may be considerable; indeed the trees may be killed unless some means is employed to protect them. Since deer are the property of all people of the state, a person owning an orchard obviously has no legal right to kill the deer merely because they are damaging his orchard. It is his responsibility to properly fence, or to in some other way protect his orchard. Until recently, fencing was the only successful method of protection known and probably still is the best when all

things are considered. However, blood-meal and bone-flour have been found to be effective in protecting trees. These preparations mixed with water in proportion of one pound to five gallons, with a little glue for sizing, can either be sprayed or dusted, for instance, by means of a whisk broom, on the foliage within reach of deer. Their odor or taste, or both, are not at all to the liking of any of the browsing mammals and acts, it is said by the numerous people that have used it, as an effective repellent. Decaying meat of almost any kind is said also to be effective.

BAGGING BROADBILLS IN CALIFORNIA WATERS.

By COBURN F. MADDOX.

During July, August and September, when our waters are at their warmest temperature, is the time of year the swordfish fishermen are busy. They equip their boats with a plank bowsprit 12 inches wide by 24 feet long, six feet inside the bow securely bolted to the deck with 18 feet extending out over the water. A waist-high rail is erected on the end, extending back on both sides about three feet. This so-called "pulpit" is held in position by steel wire stays running to the mast, the keel and each side of the boat so there is no sideways motion and only what up and down motion as would be caused by the boat itself pitching from the motion of the sea; this plank being so securely fastened as to be an integral part of the boat. Two men comprise the crew, one man to operate the boat and one to act as lookout and harpooner.

When the swordfish is sighted the harpooner takes his position in the "pulpit" and rests the harpoon horizontally across the railing of the "pulpit" and the helmsman gets the boat into the wind at full speed ahead so that the boat may get upon the fish while he basks in the warm surface water as is his habit. The harpooner balances the 14-foot shank of his barbed toggle-headed harpoon in his hand, lifts it, poses it above his head and hurls it when within fifteen feet of the unsuspecting target unless the fish becomes startled and starts to sound, then he casts instantly if the fish is not over 25 feet away. It is not often the swordfish are aroused by the approach of the boat, seeming gorged and sleepy, and the harpooner usually aims and strikes at the back of the head or where the head and body join and if his aim be true, not making another attempt necessary, but sometimes the harpooner gets as many as three casts before arousing Mr. Broadbill, whose family name is *Xiphias gladius*, and, like the gladiators of old, who also derived their name by the sword, he is a real battler when aroused. He attempts repeatedly to cut the line with his sword, which averages three feet in length and tapers from four inches to a flat, curved point one-half inch in width and, instead of sounding instantly as most fish do, he will roll from side to side, turning completely over in the water in his efforts to dislodge the barbed head of the harpoon. This head is attached to a quarter inch in diameter line about 300 feet long which is fastened to a five or ten gallon wooden keg. This keg is heaved overboard as soon as the victim is struck and when he sounds it acts as a buoy to tire him, as the deeper he goes the greater the

resistance, causing him to return nearer the surface, and also is a marker for the fishermen. This sounding and returning to the surface sometimes is repeated two or three times before the broadbill is brought to gaff. The reason for this method of catching the broadbills is that their flesh is, comparatively speaking, soft and if a line were secured to the boat the great weight of the fish pulling on a nonresisting line would tear the harpoon head out of the flesh, as they average 400 pounds in weight, sometimes growing to considerable size, one being delivered to the fishermen's pier at San Diego in the summer of 1925 that weighed 865 pounds.

When angled for on light tackle great care must be taken that these gladiators do not get under the boat, as the line may be cut by the propeller if Mr. Broadbill does not succeed in cutting it himself.

One of their peculiarities that makes them more or less easy prey to the commercial fishermen is the fact that a group of eight or ten swordfish seem to inhabit a certain locality to which they are attracted by food or temperature of the water and all the swordfish in the vicinity congregate at these chosen areas of about ten acres square and a fisher-



FIG. 63. Harpooning broad-billed swordfish for market, San Diego, summer 1927.
Photograph by Coburn F. Maddox.

man may secure one or more from one of these gatherings before the others take alarm and move to some other selected place, moving singly or by twos, not in schools, as is usually the case with fish, but more independently.

This swashbuckler of the sea is not a popular fellow among fishes, attacking with the slightest provocation any other fish and fighting to the death. One was brought in recently with his sword severed close up to his head, great chunks torn out of his sides by sharks, having evidently been attacked by more than one shark, but was still living,

showing the wonderful vitality of the fish. They are not popular with the commercial fishermen either, as they attack tuna in nets, cutting the nets and searing the tuna and splitting up the schools, making it difficult for the fishermen to secure the tuna so much in demand by our packing industry. Their method of feeding when they get into a school of small fish, like mackerel or sardines, is to lash about them with their swords, killing and stunning all they can and then picking them up at their leisure.

The meat of the swordfish is a delicious, rich, white meat, somewhat resembling young pork, and is considered a delicacy in the retail market where it competes in price with the albacore, so-called "chicken of the sea," bringing in many cases as high as \$300 per ton.

The public has shown its appreciation of this delicious food fish by the demand for swordfish meat having increased in San Diego markets from 33,005 pounds during the whole year of 1926 to 58,582 pounds in the first six months of the 1927 season, these figures being on the broadbills caught locally only; there having been some few thousand pounds imported from Mexican waters.

Due to the fact that the broadbill is what the trade calls "a good shipper," he demands a good price and can be kept much longer under ordinary refrigeration than any other fish of his size and is in great demand as a table delicacy. The broadbill does gain certain popularity dead that he did not enjoy while alive, as history has proved to us is often the case in the careers of men as well as fishes.

FISHING CONDITIONS IN LAKE TAHOE.

By GEORGE A. COLEMAN.

The resorts around Lake Tahoe persistently reported excellent fishing has been the rule this year during the trout season. These reports reached the Fish and Game Commission and the author was instructed to make an investigation of them to ascertain the cause of such good fishing. Hence, the month of June was spent in making an investigation of fishing conditions in Lake Tahoe.

The reports I find to be true, and, in seeking for the cause, I find that a number of factors enter in. Foremost of these factors that have made for such uniformly good conditions is the introduction of the several species of trout that are now being caught in such numbers. In fact, the results of the work of the Commission are just becoming evident. Without embarking on a history of the introduced species, it is sufficient to say that the Commission realized a number of years ago the necessity of placing in the lake a species of trout that would supplement the native species, since the latter were much diminished in numbers. Owing to their habits, they did not offer sufficient sport to the people who patronize the resorts and who, though not expert fishermen, desired to fish in the lake.

To appreciate the work of the Commission it is necessary to have an understanding of the various species of trout now existing in the lake.

The native trout (*Salmo henshawi*, Gill and Jordan) formerly occupied the entire system of lakes and streams extending from Pyramid Lake in Nevada to Fallen Leaf Lake and the Upper Truckee in Cali-

fornia. This trout can apparently adapt itself to greatly diversified conditions and exist under unbelievable circumstances, or it would have been extinct long ago. Formerly having the run of the Truckee River, Tahoe and Fallen Leaf lakes and all their tributary streams and breeding throughout this extensive area, it was easily able to maintain itself. However, when the timber of this watershed was logged off the flow of these streams was seriously diminished during the critical period of growth of the young trout. The run of mature trout up the Truckee River to their spawning beds was stopped by irrigation and power operations thereon and their natural breeding rate was accordingly greatly tampered with. Add to this, commercial fishing in the lake and uncontrolled sport fishing, along with a few epidemics, and the diminished supply of this native trout is explained.

Meanwhile it has been the work of the Commission to assist this trout in maintaining its hold in Lake Tahoe by taking its eggs and by exercising proper technique obtaining a many times larger percentage of fertilization than is obtained in the natural spawning of the fish. Then by hatching these eggs in the two hatcheries maintained by the Commission on the lake for this purpose, it is possible to rear many thousands of young Tahoe trout annually, thus replenishing the stock in the lake. That the work of the Commission in this line has been successful, is evidenced by the fact that this year the Commission has been able to obtain a larger number of Tahoe trout eggs than for many years past. Both males and females were found to be in perfect physical condition at the time of their spawning in April and May. Another evidence of the Commission's success is the fact that many fine specimens are now obtained in the lake by fishermen who know how to fish.

With this good start, it will be but a matter of a few years until the Commission will be able to restore the lake trout fishing to something like its former excellence. This will not be possible, however, unless the Commission has the complete cooperation of all the resort owners, patrons and sportsmen around the entire lake, not only in California, but in Nevada as well. It will be necessary to use the streams tributary to Lake Tahoe for the growth and development of the young Tahoe trout to the exclusion of any other species of trout for a few years at least. It may even be necessary to close these streams to summer fishing for a time in order to protect the young trout. The reason for such action is due to the natural habit of the young trout to run up these streams for food. When they are put in these streams late in the summer or early fall from the hatcheries, they have several months in which to grow before the snows of winter. During the winter of their first year, they are found in the deep pools of the streams until early spring. In the winter all the small streams, which are entirely dry in summer are covered with snow, under which myriads of insects are developing. As soon as this snow melts sufficiently to form running streams, the young lake trout begin to run up them, even under the snow, in order to obtain the abundant insect food. Here they soon attain a size of from five to seven inches in length. Now if these young trout are *not caught* out during the summer, they drop back into the lake in the fall and soon grow to be the half-pounders, pounders and pound-and-a-half trout which are so desirable during the

fishing season. If, therefore, we would have an abundance of all sizes of native trout available during the open season in the lake, *we must protect the young trout in the streams.*

The Mackinaw trout (*Christivomer namaycush*) was introduced into Lake Tahoe about fifteen years ago. It has done so well that it now furnishes the very best sport for anglers and even is taken with profit by commercial fishermen. The reason for its success is *not* due to the fact that the Mackinaw has destroyed the other trout, *but* because the Mackinaw has adapted itself to the food conditions in the lake and has found suitable breeding grounds. It has propagated and increased enormously from year to year, until it has become the most numerous of all the trout in the lake.

Recent investigations by the author show that the Mackinaw is entirely a bottom feeder. Its food consists of snails, deep water insect larvae, crustaceans and small fish which also feed on the bottom; such as bullheads, suckers, chubs and some species of minnows. Thus, it is a very efficient agent in working over undesirable species of fish into a very desirable sport fish and a very delicious food fish. Owing to its food habits, this trout is found in the deepest holes in which it is possible for any trout to exist. Hence, fishermen who go after it in these deep holes with several hundred feet of line and the proper tackle, have uniform success in landing big fish. Such fishermen soon reach the limit very quickly and have a good catch of trout weighing from six to fifteen pounds. Every specimen examined by the author, and they have been many, has been a beauty, in perfect physical condition, very fat and with firm flesh.

Only a few years ago the Commission introduced into Lake Tahoe the steelhead trout. This season's fishing alone has demonstrated abundantly that this trout has been a success in the lake. It is found mostly in comparatively shallow water—10 to 50 feet—and is obtained by surface trolling with a light spoon outfit. As a result it furnishes plenty of sport at the opening of the season, and, when the weather will not permit trips to deep water, good catches are often made in shallow, calm water or even from the resort piers.

The breeding season of the steelhead in the lake has been determined as the latter half of June, possibly running into July. Six-pound females, which had just finished spawning, but were still in good physical condition, were not an uncommon catch the latter part of June this season. Fishing for steelhead in the lake should therefore be confined to the first half of June and to September and October.

These investigations prove conclusively that the native and introduced species of trout in the lake have succeeded in segregating and adapting themselves to the existing food conditions in the lake suitable for each respective species. They have also found the proper breeding grounds, and grounds at that, in which they do not interfere with one another. They are therefore living and increasing, each species in its proper environment.

It is the purpose of the Commission to make a thorough study of the food supply and conditions of existence in the lake in general and in every part of it in particular. This is, of course, a work requiring years of study and investigation. From time to time it is hoped that

data may be obtained which will warrant the introduction of other species of fish to the end that good fishing may be had at all times, and at any time, by all classes of sportsmen and for those who do not claim to be sportsmen, but who, as patrons of the Lake Tahoe resorts, like to fish in the lake.

POACHERS AND GAME LAW VIOLATORS.

By WALTER R. WELCH.

For ages men have been accused of violating the game laws and usually with reason, for love of forbidden sport or dire necessity are strong motives.

In these days when the conservation of our wild life is attracting so much general attention, it is of interest to consider what has been the history of the game laws.

Under the tyrannical game and forest laws introduced by the Norman kings, the punishment for killing the king's deer was the loss of eyes, besides other shameful penalties.

This will easily account for the many banditti which formerly lurked in the royal forests, and which, with their superior skill in archery and knowledge of those unfrequented solitudes, found it no difficult matter to resist or elude the civil power. Among all these, the most famous was Robin Hood.

"In this time (about the year 1190, in the reign of Richard I)," says Stow in his annals, "were many robbers and outlaws, among the which Robin Hood and Little John, renowned thieves, continued in the woods, despoiling and robbing the goods of the rich. They killed none but such as would invade them; or by resistance for their own defense.

"The saide Robert entertained an hundred tall men and good archers with such spoils and thefts as he got, upon whom four hundred (were they ever so strong) durst not give the onset. He suffered no woman to be oppressed, violated, or otherwise molested. Poore men's goods he spared, abundantlie relieving them with that which, by theft, he got from the abbeyes and the houses of rich earles, whom Maior (the historian) blameth for his rapine and theft, but of all thieves he affirmeth him to be the prince and the most gentle thiefe."

The personal courage of this celebrated outlaw, his skill in archery, his humanity, and especially his leveling principle of taking from the rich and giving to the poor, rendered him the favorite of the common people.

Although often referred to as the "Prince of Poachers," Robin Hood's memory has been celebrated in innumerable ballads, some of them doubtless dating back to the far-off Norman days, when he held sway in Sherwood Forest, in Nottingham shire, and feasted his followers on the king's fat deer.

Nicholas Rowe, the first editor of Shakespeare (1709), asserts that the latter "had, by a misfortune common enough to most fellows, fallen into ill company, and amongst them some that made frequent practice of deer-stealing, engaged him more than once in robbing a park that belonged to Sir Thomas Lucy, of Charlecote, near Stratford."

The Reverend Richard Davis wrote, about 200 years ago, that Shakespeare "was much given to all unluckiness in stealing venison and rabbits, particularly from Sir Thomas Lucy, who had him often whipped and sometimes imprisoned, and at last made him fly his native country." The young poacher, who had "broken the park, stolen the deer, and kissed the keeper's daughter," is said to have been seized, brought before the indignant magistrate and treated with so much severity by Sir Thomas that he revenged himself on the rural magnate by affixing doggerel verses to the gates of Charlecote.

The wrath of the magistrate is declared to have blazed so high at this additional insolence that Shakespeare was obliged to withdraw himself from more serious prosecution by escaping to London.

Additional embellishments to the tale are that the young poet stole the buck to celebrate his wedding day, and that Queen Elizabeth intervened to protect him from Sir Thomas's fury.

In the fifth year of Elizabeth (1562-1563) it was enacted that if "any person unlawfully entered into any park impaled, or any other several closed with wall, pale or hedge and used for keeping, breeding and cherishing of deer, and wrongfully hunted, took, or killed any deer, he should suffer three months' imprisonment, pay treble damages to the party offended, and find securities for seven years' good behavior."

The modern game laws of England replaced the old forestry laws, under which none but persons of birth or estate were allowed to kill game, and under which game keepers were given the right of search and other legal powers.

The first of the modern English game laws was passed in 1828. It is known as the "Night Poaching Act," and under its provisions the local magistrates are empowered to inflict heavy penalties for the crime of poaching. "Any person who unlawfully takes or destroys any game or rabbit, whether on open or enclosed land, or who shall at night unlawfully enter or be upon land with any gun, net, engine, or other instrument for the purpose of destroying game, is, upon conviction before two magistrates, liable to be committed to jail for a term not exceeding two months with hard labor, and at the expiration of his term of imprisonment may be called upon to find sureties for his not so offending again. For a second offense he may be sent to jail for six months and in default of finding securities for his future behavior, the prisoner may be detained in jail for a further period of twelve months; a third offense is a misdemeanor (*sic* should be felony) and the offender may be sent to penal servitude for a term of not more than seven years. In a case of this kind the accused would be tried at quarter sessions."

In 1832 unreformed parliament decreed a closed time for hares, pheasants, partridges, grouse, heath and moor game, black game and bustards, made trespassing in pursuit of game a criminal offense and established a system of licenses for the killing and selling of game.

Trespassing in the daytime in pursuit of game is, by this act of 1832, made punishable by a fine not exceeding two pounds and costs, and where five or more persons engage in the trespass, each is liable to a fine not exceeding five pounds. By the same law, when a farmer kills game which, in his agreement with the land owner, is reserved by the land owner, he makes himself liable, not for a breach of contract

for which damages can be recovered in a county court, but to criminal proceedings before the magistrate.

The game laws, passed after the parliamentary reform of 1832 and by a House of Commons elected by the people of the middle classes, began with an act which came into force about 1835 and made it a penal offense to take game on the highway at night. This was followed by another act, passed about 1863, which gave power to policemen to search persons whom they had good cause to suspect of coming from any land where they may have been unlawfully in pursuit of game. Under this measure the policemen apply to the magistrate for summons against suspected persons, who, if convicted at petty sessions, are liable to a fine not exceeding five pounds. All game and all implements for snaring and killing game found in possession of these offenders are forfeited under the measure. The county police force act vigorously with the game keepers in preserving game. The police are not supposed to act as game watchers on private lands, but undoubtedly they often act in concert with the game keepers in preventing poachers and in bringing the poachers to the police court.

The ground game law of 1880 was passed to relieve tenant farmers of some of the provisions of the act of 1830.

As the law stood, a farmer might be summoned to the police court for killing a hare on land in his own occupation. Under the act of 1880, "every occupier shall have as incident to and inseparable from his occupation of the land" a right to kill and take the ground game thereon. He now enjoys this right concurrently with the landlord or with the person to whom the landlord has assigned the right to other game, and a tenant can not sign away his right when making terms with the landlord for the occupation of the land.

The granting of licenses to carry a gun and to kill and sell game is in the hands of magistrates and officers of the Inland Reserve Department. The law makes it an offense to buy game from others than persons licensed by the magistrate.

An examination of the laws of the United States shows that deer were the first game sought to be protected.

In South Carolina as early as 1769, and in Vermont in 1797, a law was passed which prescribed a closed season for deer from January to July.

In 1817, Massachusetts protected deer during a similar season, followed by Virginia in 1820. Little other legislation, except in New Jersey in 1846, is found until after 1850, when Missouri, Ohio, Alabama, and California prescribed closed seasons.

In the sixties came Kentucky with protection for does only.

The establishment of seasons during which deer could not be killed, although much shorter than the present day game laws, recognizes the need of protection during the particular time of year when destruction is easiest and during the season of mating and rearing of young.

The lowest penalty for killing deer appears to be named in a North Carolina statute passed in 1854, which provided: "If any person shall kill or destroy any deer running wild in the woods or unfenced grounds, unless on his own lands, by gun or otherwise, between the 20th day of

February and the 15th day of August next succeeding, he shall forfeit and pay for every offense \$4.00 to any person who will sue for same."

What has been known as "night hunting," especially with fire or artificial light, has been the subject of prohibitive legislation since an early date, South Carolina having prohibited taking of deer by that means in 1769, and Tennessee in 1774.

Limitations upon a day's bag of game have also been a more or less effectual means of checking the wholesale destruction of game, but such provisions are of later date, most of them having come into the law since 1880.

It is rather surprising to find that the restriction of hunting to residents of the state came into protective legislation at a comparatively early date. In 1846 New Jersey prohibited non-residents from hunting on another's land under penalty of \$15.00, and the forfeiture of the offender's gun; while Delaware in 1852 required a non-resident to have a license from the land owner; in 1852, Maine passed a law providing that "all foreign citizens and Indians belonging in the British provinces are hereby prohibited from killing any moose or deer within the limits of this state, and any person violating the provisions of this act shall forfeit all moose and deer hides found in his possession."

Coming to the present day game laws, special comment is uncalled for and general observations impossible. The development, during later years, of legislation looking to game protection, can best be marked by comparison of the revised statutes of any state today and those of 20 or even 10 years ago.

If any one cause can be fixed upon, aside from increase in population, to account for the danger which threatens game and wild life everywhere, it is bringing the fields and forests into almost instant accessibility by means of the automobile. The need today is not more legislation, but greater strictness, shorter open seasons, smaller bag limits, and the setting aside of tracts of land and forest areas, not as parks, but reserved for game with no open season.

These things must, and will, come and doubtless will come speedily.

At the present time, the most important violations of the game laws in California consist of the "bootlegging" of ducks, and "drag-shooting" with automatic shot guns by market hunters, duck shooting at night, the use of "spot lights" in hunting deer at night, and the killing of various species of game birds and animals during the closed season, commonly called "soonering."

As the game laws become more extensive in their scope and more stringent in their provisions, the need of special officers to make them effective will be manifested, as the game laws of the United States are enacted for the benefit of all of the people and not in the interest of any privileged few.

Interesting, indeed, are the early enactments having for their purpose the protection of game.

Under the laws of England, the ownership of the game and the right to hunt same was vested in the sovereign and delegated to his lords and others whom he pleased to favor, with the result that those who violated the game laws were looked upon and referred to as being poachers and were subject to severe punishment.

Under the laws of the United States, the wild game belongs to the people in their collective capacity, and is not subject to private ownership except in so far as the people may elect to make it so, with the result that those who violate the game laws are taking game that belongs to the people.

As the great majority of game law violations in the United States take place on lands that are open to public shooting, the violators of the law are not looked upon and referred to as being "poachers," but as being "game law violators."



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November 5, 1927.

"The preservation of animal and plant life, and of the general beauty of nature, is one of the foremost duties of the men and women of today. It is an imperative duty, because it must be performed at once, for otherwise it will be too late."—Henry Fairfield Osborn.

NEW COMMISSIONERS APPOINTED.

On September 2, 1927, Governor C. C. Young announced that Mr. I. Zellerbach, who has headed the Fish and Game Commission since January, 1926, had been retained on the Board and that two new men had been appointed. Within a week, the new Commission had met and organized, and it was understood that the progressive policies of the past regime are to be continued. Both of the new commissioners are well-known sportsmen of southern California and will bring worthwhile knowledge to their new position.

In announcing the appointments, Governor Young gave out the following statement:

"As members of the Fish and Game Commission, I have this day appointed George B. Clarkson of Los Angeles, Reginald S. Fernald of Santa Barbara and I. Zellerbach of San Francisco.

"Mr. Clarkson and Mr. Fernald are new members of the Commission and were appointed for their very great interest in matters connected with the wild life of the state. Mr. Zellerbach was a member of the former commission and is named in deference to an almost universal demand from sportsmen all over California, who have been impressed with the faithful and intelligent work he has already done toward preserving our fish and game.

"To many of our citizens the Fish and Game Commission is a body of extreme

importance. There is a feeling that California has yet much to learn in fostering and conserving her wild life. The hunter and the fisherman are more than willing to pay their license fee if only they can be satisfied that those fees shall all go solely to the intelligent propagation and preservation of our fish and game.

"Accordingly, it is proposed that our new State Department of Natural Resources, with its division of fish and game, shall see to it that more is done in this direction henceforth than ever before. It is pledged to see to it that overhead is reduced to an absolute minimum, and that every dollar contributed by the sportsmen of the state shall be so expended as to build up to the utmost those all-important resources of California."

FOUR-YEAR PROGRAM INAUGURATED.

Owing to the increased license fees for hunting and angling which became partially effective this year and the extra revenue from the deer tag licenses, the Commission has been privileged to initiate the four-year program which it presented to the Legislature at its last session. The features of the first year's program are fundamental to the whole plan and will make for more efficient and effective administration of the state's fish and game.

The addition of thirty new full-time deputies to the Department of Patrol will guarantee greater law enforcement, better law observance and more certain preservation of wild life. Perfection of fish rescue work will make possible the saving of fish stranded in lakes and streams going dry. Completion of the fish planting system, which the patrol department has successfully handled this year, will result in a less wasteful distribution of young fry and assure more sport to anglers throughout the state. Surveying and posting the thirty-four state game refuges will aid greatly in conserving the life in the refuges, as the signs will notify hunters where the pursuit must stop.

A new speed boat for the upper bay region and several knockdown boats with out-board motors to be carried by deputies on their automobiles for use on mountain lakes and streams will make these areas more easily patrolled.

Four new hatcheries will be constructed this fall: one near Bridgeport in Mono County, another on the Kaweah River, one on Cold River in Mendocino County and another on the Kern River. Experimental egg-taking stations will be established on Smith River in Del Norte County and Prairie Creek in Humboldt

County. Two new biologists will be added to the staff and a definite survey plan inaugurated of all streams and lakes in the state. Ponds will be built at the hatcheries to age fish to larger size.

The Bureau of Education will continue to make serious effort to cultivate conservation sentiment in growing and developing minds. Two new full-time lecturers will be engaged to cover the lower grades and the high schools. A complete motion picture equipment has been purchased and many new reels depicting the principal activities of the commission in its work of protection and preservation will be added to the present stock. The reference library, recently established, will be greatly augmented. Material pertaining to wild life conservation will be made available for the first time to the Commission's employees and to the public at large.

The Research Bureau of the Commission will inaugurate studies with a view to a more scientific and thorough knowledge of conditions obtaining in the state in regard to certain kinds of game birds and mammals. A zoologist and pathologist will be added to the staff and laboratory equipment installed. Very soon the Commission will be able to cope thoroughly with all problems of bird and mammal disease.

A new game farm will be built immediately in southern California so that next year the output of pheasants alone should be 20,000.

The cooperative program, in conjunction with the State Board of Health, for investigation of pollution throughout the state will be set on foot. A joint laboratory will be maintained by both departments for the purpose of investigating the kinds of pollution of our streams, lakes and bays with a view to obtaining knowledge on the best methods of controlling them. Added help in the Hydraulic Department will also enable the Commission to complete its survey and force the installation of fish screens and fish ladders where necessary.

DEPARTMENT OF NATURAL RESOURCES.

Conservation does not belong to those engaged in forest protection. It does not belong to those interested in fish and game. It does not belong to those interested in minerals or water supply. Conservation is really a program that includes all natural resources. The wide demand for a unification of the various conservation programs carried on by the state has resulted in the formation of a State Department of Natural Resources. With this unification should come a widening

and improved conservation program which will make each department of the state dealing with natural resources work in harmony and with one purpose.

Of particular benefit will be a possible unification of the educational work relative to forest protection and fish and game protection. Heretofore to some it seemed improper to mention forest protection along with fish and game conservation. In the future, under a Department of Natural Resources, it will not only be allowable but necessary. Why should trees and animals be studied apart? They are definitely interrelated. Education is not the possession of one Bureau, but it is the most important conservation method. It should be used by all interests which have to do with natural resources.

"Popular education in natural history affords a foundation for the intelligent demonstration of all natural resources."

This has been the aim in the summer resort educational work carried on for many years by the Fish and Game Commission. It has borne worthwhile results; it will bear greater results in the future.

SURVEY OF GAME REFUGE BOUNDARIES PLANNED.

California possesses as fine game refuges as are to be found in any state. Some of them are very large; most of them constitute valuable breeding areas for game birds and mammals. The boundaries of these refuges have been defined by law, and mapped. They have been partially posted. However, there has been continued complaint from hunters that the boundaries are not well defined and are not properly posted so that a man does not know when he leaves open hunting ground and enters a game refuge. The need, therefore, for a survey which will definitely mark boundaries and for complete posting of them is obvious. It is with pleasure that the Division of Fish and Game reports that a surveying party is now in the field which will definitely locate the boundary of every game refuge and make suitable maps of each. The same party will see to it that the boundaries are properly posted.

DEER KILL, SEASON 1927.

At least 1200 deer were killed on the first day of the 1927 season, according to the information received by the Division of Fish and Game from the duplicate deer tags received from the hunters themselves.

Duplicate tags show that two hunters killed deer at 5 o'clock on the opening day. The biggest buck of the day was a

seven pointer that Paul Bianchi, Jr., of Gonzales, killed at Eva's Flat, west of Gonzales, in Monterey County. The next largest was a five pointer killed at 6.50 in the morning by Earl T. Dayton at Duncan Mills in Sonoma County.

The total kill in the coast counties reported by August 30 was 4924. This real check on the deer kill thus far does not radically change the old estimates of previous years of the total kill for the state. However, the figures will now be dependable.

Under the new deer law it is possible in California to secure information not available in any other state, and the first

end totals are quite evident, fewer deer being killed during the middle of each week. Except for the end of the season rush the first days of the season show largest totals.

During the month of September the first returns on deer killed in Del Norte, Humboldt and Siskiyou counties (District 1½) began to arrive, but tabulation was still incomplete when this was written.

AN UNAPPRECIATED NATURAL RESOURCE.

The role that fur-bearing mammals have played in the history and develop-



FIG. 64. Sculling the sloughs for wild ducks in the Suisun marshes. Up with the flood tide and back with the ebb. Photograph by W. W. Richards.

day's mail brought to the commission's office data that have already proved the new law to be invaluable. By knowing the number taken in various parts of the state, better conservation measures can be instituted.

Returns are incomplete but on October 1st about 14,000 tags had been received. At that time, the largest number killed was reported from Mendocino County, 1406; 864 from Lake County; 710 from Sonoma.

Tabulation of the figures is so arranged that instant comparison can be made on the basis of district, county or day. Week-

ment of America is indeed remarkable. Due to the rivalry of the fur-trading companies, some of them amounting to imperial organizations, the continent was explored and outposts of civilization flung out into the wilderness. Many fortunes were amassed and the wealth acquired in the traffic of furs equaled that of the fabled mines of Peru.

Lack of foresight and want of appreciation of the worth of this natural resource has resulted in its sad dissipation. Yet even now, with only a remnant left of the once rich and varied stock of fur-bearers with which California was

originally endowed, the trappers' take nets a tidy sum. The estimated value of the commercial trappers' catch last year is \$258,000. If this sum be considered as interest at four per cent, then six and one-half million is the representative principal and the value of fur-bearers to the state.

Assuredly such an asset should be made permanent by wise conservation. California would then be able to count on a yearly revenue of a quarter of a million dollars which would otherwise not pour into its coffers.

THE VALUE OF THE TRAPPERS' CATCH.

All trappers are expected to report their catch. Because of this fact it has been possible to compile the following figures which show that the trappers still reap a valuable harvest of fur in California.

Species	Estimated No.	
	1924-25	1925-26
Skunk	29,092	28,107
Raccoon	11,006	13,358
Gray fox	8,301	8,878
Coyote	8,043	8,509
Wild cat	5,443	6,087
Civet cat	3,364	4,292
Beaver	-----	4,019
Muskrat	3,120	6,207
Mink	3,066	3,394
Ringtail cat	2,304	2,698
Kit fox	1,261	272
Marten	1,086	472
Badger	457	496
Opossum	356	613
Weasel	338	227
Bear	227	292
River otter	142	141
Fisher	68	30
Mountain lion	65	75
Red fox	45	18
Wolverine	3	-----
Totals	77,787	88,185

Species	Average price	
	1924-25	1925-26
Skunk	\$1.265	\$1.406
Raccoon	3.23	4.392
Gray fox	1.852	1.928
Coyote	4.412	4.048
Wild cat	2.24	2.047
Civet cat	.476	.68
Beaver	-----	12.366
Muskrat	.463	.633
Mink	4.635	5.548
Ringtail cat	2.018	2.414
Kit fox	1.949	2.035
Marten	10.677	11.108
Badger	1.578	1.723
Opossum	.634	1.038
Weasel	.792	.742
Bear	8.50	6.92
River otter	12.26	13.446
Fisher	36.784	25.124
Mountain lion	15.80	14.071
Red fox	18.583	14.859
Wolverine	10.00	-----

Species	Estimated value	
	1924-25	1925-26
Skunk	\$36,721 65	\$39,517 29
Raccoon	36,099 88	58,667 82
Gray fox	15,373 45	17,117 15
Coyote	35,485 72	34,447 52
Wild cat	12,192 32	12,460 52
Civet cat	1,601 26	2,918 37
Beaver	-----	49,698 95
Muskrat	1,444 56	3,929 03
Mink	14,310 91	18,829 77
Ringtail cat	4,649 47	6,512 34
Kit fox	2,457 69	553 52
Marten	11,599 70	5,244 97
Badger	720 15	854 61
Opossum	225 70	642 29
Weasel	267 70	168 43
Bear	1,929 50	2,018 76
River otter	1,740 92	2,051 01
Fisher	2,501 31	755 61
Mountain lion	1,027 00	1,055 33
Red fox	836 24	268 13
Wolverine	30 00	-----
Totals	\$181,215 13	\$257,711 42

	1924-25	1925-26
Number of trapping licenses issued	2,984	3,530
Number of trappers reporting	1,933	2,338
Per cent reporting	64.8%	66.5%

Two changes in the trapping laws became effective on July 29, 1927. The trapping season now opens on November 15th instead of October 15th. This change stops the taking of many unprime furs which have but little market value, and materially increases the returns of most trappers. The other change in the law adds kit fox, beaver and muskrat to the list of fur-bearers and gives necessary protection to these animals.

GAME MANAGEMENT.

Even those who do not keep track of developments in forestry are conversant with the term "forest management." It has only been recently, however, that the term "game management" has appeared in conservation literature. Historically, the attitude on game conservation has developed about as follows:

1. Profligate expenditure of natural resources.
2. Rumors of depletion.
3. Public awakening to needs of the future.
4. Scientific utilization of natural resources.

Naturally the term "game management" fits in with this last development. A recent editorial in *American Forests and Forest Life* attempts to point out that in planning game management choice must be made of three projects:

1. Restore herds of former days.
2. Save a few at which to look.

3. Find a profitable way of utilizing the surplus.

We are not so sure that it is a matter of choice of one or the other of these projects; rather it is the inclusion of all three projects plus several others. All three projects are worthwhile. It seems more reasonable that we should have a few big game animals saved to look at. Visitors to national parks usually gain a greater thrill from the sight of a wild deer or bear than from the scenery that surrounds them. At the same time there are certain areas that should be employed as propagation grounds for animals with the direct view to utilizing the surplus. In attempting the third project we might very well look to the first one, the actual restoration in certain areas of former numbers. This might mean restriction of grazing, furnishing of better food supply and other useful means looking toward an increase.

Game management is an inclusive term. No one yet has given us a definite outline of the main lines of attack to be used by anyone who might call himself a game manager. The term will continue to be rather intangible until something concrete is suggested. Within the next few years there will be forthcoming the aims, the methods and the means which will make this new term, "game management," more understandable.

HATCHERIES TO SERVE FULL TIME.

One of the plans for the coming year includes the continual use of a number of the state's hatcheries. The importation of European trout and others from the eastern United States brought to California species which deposit their eggs in the fall rather than in the spring, as do the native trouts. It seems a feasible plan, instead of closing some of the smaller hatcheries for several months each winter, to have shipped to them eggs of fall spawning trout. The resultant fish will be of size sufficient to place in holding tanks by the time shipments of rainbow and other spring spawners are obtained. Some of the hatcheries are so situated that they can not be operated in midwinter, but in other instances this plan seems feasible and will be tried out. This is the plan projected for the Yosemite Hatchery and, accordingly, winter visitors to Yosemite will have an opportunity to see the hatchery in full operation.

MOUNTAIN LION CONTROL

State lion hunter, Jay Bruce, has now a total of 315 mountain lion scalps to his

credit. Last year he bettered his average by taking 36, the largest number yet secured in a single year. By September 1st of this year he had secured 31. He accounts for the better record this year as being due to a camp helper who has enabled him to spend more time actually on the hunt. The past spring was spent in San Diego and Ventura counties. In San Diego County four were secured, whereas six fell to his prowess in Ventura County. All of this was accomplished in spite of trouble with sick and injured dogs. At the present time his dogs are in fine working condition and several younger animals are being trained.

Mr. Bruce is considering an enticing offer to try his prowess in securing man-eating tigers and other large cats in the Orient. Such an expedition as is planned would take Mr. Bruce from his work temporarily, but would increase his knowledge and ability at trailing and killing the most noted among predatory species.

SUMMER RESORT EDUCATIONAL WORK.

As in past years the Division of Fish and Game has cooperated with the National Park Service in a nature educational program in Yosemite National Park. There are three outstanding features of the work: Lectures are given nightly at various resorts, a school designed to train nature guides and teachers of natural history, holds a seven-weeks' session and thousands are led afield on field trips to study nature first hand. The final reports show a trebling in attendance on the field trips, which is the more unique and important feature of the work, and are as follows:

YOSEMITE NATURE GUIDE SERVICE, EIGHTH SEASON, 1927.

Lectures—	Number Attendance	
Camp Curry.....	34	48,200
Yosemite Lodge.....	23	11,050
Museum Campfire.....	6	543
Special lectures.....	11	2,560
Geology at Museum.....	254	11,300
Glacier Point.....	88	8,258
Yosemite Hatchery.....	128	18,000
Totals	544	99,911
Field Trips—		
Camp Curry (adults).....	149	3,586
Camp Curry (children).....	55	735
Yosemite Lodge.....	104	1,727
All day.....	23	837
Glacier Point.....	48	522
Special.....	45	1,301
High country.....	7	221
Totals	431	8,929

A staff of eight men was employed by the National Park Service to give aid along the lines indicated. A special fea-



FIG. 65. In the act of making conservationists out of summer vacationists. A nature guide party in the field in Yosemite Valley where more than 10,000 receive instruction along conservation lines through the study of living things—not printed words. Photograph by George Stone.

ture of the work during the past summer included the development of a children's story hour and of children's field trips. After six weeks of study on the floor of the valley, students of the School of Field Natural History spent a week making studies at timber line. Requests for an opportunity to return and continue their studies leads to the conclusion that they found the work very worthwhile. From a conservation viewpoint no more important work could be done than to train a group of teachers and send them out to different parts of the state.

SAFETY FOR PHEASANTS.

Owners of land stocked with pheasants are showing an interest in the permanent establishment of this fine game bird in the fields of the state. Many farmers in areas given over to alfalfa and grain crops, on discovering pheasants nesting in their fields, have protected the birds. Some have refrained from cutting the area immediately surrounding the nest; others have set up markers and endeavored to disturb natural conditions as little as possible when harvesting their crops; still others, who were unable to do this, have gained permission to hatch the pheasant eggs under domestic hens. By means of such cooperation splendid results will attend the attempt to introduce the pheasant in California.

Another aid in the protection of the bird comes in the posting of land on which pheasants have been liberated. Accordingly, planting sites are being signed with warnings as follows:

WARNING

California Fish and Game Commission has stocked these grounds with pheasants and other game birds.

NO TRESPASSING, HUNTING OR SHOOTING.

No dogs allowed on these premises. Violators will be prosecuted under Section 627 of the Penal Code of the State of California. Obey the law, avoid the penalty and protect fish and game.

PHEASANTS A BENEFIT.

Many reports praising the work done by Chinese ring-necked pheasants in the cleaning up of bugs and insects in the agricultural areas in which they have been planted have reached the Commission. A number of the farmers on whose places pheasants have been planted are enthusiastic over their presence as they do not damage grain or garden truck, but

do keep up a constant attack on destructive insects.

It is interesting to note also that reports from other states confirm the often expressed opinion that in addition to being a fine game bird the pheasant is a boon to the agriculturist.

W. E. Albert, State Game Warden of Iowa, has recently contributed an article on these birds to *American Game*, the official bulletin of the American Game Protective Association. Albert praises the birds and declares that he has proven conclusively that the pheasants planted in Iowa do not attack standing corn but do get the cut worms that are a menace to this great Iowa crop. The crops of a number of pheasants were examined and found to contain plenty of noxious insects, worms and grubs of a destructive nature.

The American Field has the following illuminating article on the Chinese ring-neck in its issue of May 7th:

"Chinese or ring-necked pheasants will be plentiful in the Finger Lakes region of central New York next fall if the report made by Hon. C. S. Wilson, former Secretary of Agriculture for New York state, may be taken as an indication of pheasant conditions for the next open season. Mr. Wilson's report was made on March 3, after a careful survey over his own extensive apple orchards and other sections of the Finger Lakes region. In concluding his report Mr. Wilson writes as follows: 'I ate breakfast with a cock pheasant this morning, and this is literally true, for as I was eating my breakfast a fine cock pheasant was strutting around just outside the window, not ten feet from the house, and from time to time he would stop to eat the corn thrown out for him. One day there were over 30 pheasants in our yard at one time. We like to have plenty of pheasants on our farms, because they consume a great quantity of injurious insects and bugs, and how they do clean out the grasshoppers!'"

THE NEW SALMON LAW.

The new salmon law was found defective and difficult to enforce, consequently a recent court decision upholding the present salmon law has been encouraging to the administrators of fishery work in California. Certain salmon fishermen in San Francisco Bay brought salmon from beyond the three-mile limit into District 10 where it is illegal to have fresh salmon in possession during the closed season. It was shown that the legislature in planning the law took

into consideration the migratory movements of the salmon. The closed seasons on the outside salmon controlling districts are designed to prevent fishermen from catching too great a proportion of immature fish, thus causing a great waste. Salmon in California are rapidly diminishing in numbers, due to inadequate protection, and this court victory will help to give this fish a fair chance to survive.

A NEW BIRD BOOK.

Bird students have waited long for a small, handy volume which would help them identify birds in the field. The one long used emphasizes the description of museum specimens rather than field characters and contains no colored plates. The publication of a four-volume, illustrated monograph has not lessened the demand for a handbook. But bird students may now rejoice in the filling of their need. "Birds of the Pacific States" (Houghton Mifflin, Boston; XIX, 353 pp., 9 colored pls., many figs. in text), by Ralph Hoffmann, will be chosen as a boon companion of every field student of birds. The author won his reputation on the publication of a handbook on the birds of New England and eastern New York. The present volume, written after seven years of work on the Pacific coast is just as usable and dependable. The nine colored plates and numerous line drawings are by Major Allen Brooks, the artist guaranteeing accuracy and beauty. The printer's art is less praiseworthy for color blending could be better.

It takes a thorough field student of birds to write a book for field students and those who have been afield with this author respect his abilities as a naturalist. Built on his own field observations, the book is what the author sought for it, readable and accurate.

Students of birds are in the habit of finding the thrushes at the very end of a bird book, but Mr. Hoffmann follows the new order to be used in the forthcoming Check List of North American Birds and places the sparrows at the end. Full biographies are impossible in a handbook so each write-up consists of a general word picture of the bird in the open, the characteristic haunts, habits and behavior which serve best to identify it. The most prominent field marks are emphasized by the use of italics. Admittedly printed words can give but a poor idea of the song of birds, yet the descriptions are useful and help to differentiate between various species. Subspecies are lumped together as they should be for the beginning student.

To everyone seeking a ready source of dependable information when stirred by the sight of an unusual bird seen in the open, this new book is highly recommended. It should find a place in many an automobile door pocket where it can be referred to "on the spot."—H. C. Bryant.

HAWK BULLETIN AVAILABLE TO TEACHERS.

A splendid booklet illustrated in color, entitled: "A Plea for Our Hawks," is being sent to teachers on application. Originally published in Nature Magazine, the booklet was arranged by the American Nature Association and a stock made available through purchase and through the generosity of the association. It is teaching material of high order.

FISHERIES STATISTICS FURNISH BASIS FOR LEGISLATION.

More and more the usefulness of the state's system of handling fisheries' statistics is coming to the fore. During the legislative session the continual complaint of the scarcity of striped bass caught by anglers led to a concerted effort on the part of sportsmen's clubs to prohibit all commercial fishing and sale of striped bass for a period of three months in each year. Another bill closed certain additional portions of the fishing grounds to commercial fishing. In defense of the first bill it was shown that the general trend of the total catch by years was downward. This was considered as conclusive evidence of depletion of the supply. The Department of Commercial Fisheries gathered the records of the catch in each boat for each day of fishing throughout the year, using twenty boats as a unit. Employing this more dependable method of showing the actual catch, it was found that the average catch per boat, per day's fishing, rose from 114 pounds in 1920 to 175 pounds in 1923, dropping to 124 pounds in 1924 and rising to 171 pounds in 1925. Thus it was shown that the figures of total catch were really of little value as an indicator of the evidence of fishing. The trend of the boat catch has been distinctly upward, indicating that the fishing is in a healthy condition. The decreasing total catch can readily be explained on the basis of diminished rainfall and the greater abundance of salmon which attracted the same fishing boats. The presentation of this evidence was sufficient to defeat the more radical bill and preserved to the commercial fishermen rights to which he is entitled. Guesswork and opinion can not compete with dependable statistics,

PHOTOGRAPHIC EVIDENCE.

Sometimes it takes only a photograph to convict a violator of the fish and game laws. Recently a Riverbank youth was so proud of a bunch of young ducks killed out of season that he had himself photographed with the game strung around his neck.

The photographer who was given the job of printing the pictures, mentioned the fact to a friend, who figured it would be a good thing for Deputy G. W. Mag-

formed that they were, admitted he had been shooting them also.

Taken into the justice court of Judge W. H. Rice at Modesto, he entered a plea of guilty and after being questioned by the judge regarding his age was held to the juvenile court, as he was but 17. Superior Judge L. W. Fulkerth placed the boy on probation until he reaches the age of 21. He took the young man's gun and he will not be allowed to hunt during his probation. Meanwhile he must



FIG. 66. A photograph that led to an arrest and conviction.

ladry of Modesto to know. The game warden called upon the photographer and secured a print of the young nimrod and his illegal kill. He called upon him and when the boy denied that he had been shooting ducks, Magladry flashed the photo. This broke the youth's haughty spirit and he confessed that he had killed the birds. He asked the warden if cotton-tails were out of season and when in-

report to the judge at regular intervals.

The stern handling of such a case makes a conservationist of the boy and is a reminder to all that game laws have a purpose and must be observed.

DEER LICKS.

It is a well known fact that deer travel many miles to utilize salt licks. The term, of course, applies to springs and

other areas where salts of various kinds are found in sufficient quantity to attract deer. Mr. Smith Riley of Long Island, New York, has interested himself in trying to answer the question of what salts afforded by these licks are necessary to the life of the deer, thus making them an attraction. Recently he had twelve analyses made from various salt licks. In most instances more than a half dozen different compounds were present in the soils from alkali licks. In each instance, the percentage of sodium was largest, with chlorine taking third place. Inquiry showed that no information was available from animal industry men relative to domestic animals, though it was suggested that sodium and chlorine are the two elements supplied by salts most likely to be lacking in the food of the deer. Phosphoric acid and calcium, also necessary to the well-being of the animals, are usually obtained in sufficient quantities from the herbage on which they feed.

This simply opens up the question as to the real attraction to be found in a salt lick. If any one has any contribution to the subject we hope he will communicate with Mr. Riley.

PERSONNEL FILE IMPROVED.

Every employee of the Fish and Game Commission was recently furnished a blank requesting information as to training and ambition. Similar blanks have always been filed with the Civil Service Commission but the time has come when a similar file is necessary within the organization in order to handle promotions more advantageously. The larger an organization grows the more necessary it is to have the personnel well fitted for the various positions. This is a fine start in the right direction.

STATE FAIR EXHIBIT.

The message of conservation, protection and propagation of fish and game in California was given in a forcible manner through the medium of attractive exhibits to those who visited the State Fair at Sacramento, September third to tenth.

In addition to the comprehensive and illuminating exhibits of fish and game birds shown last year, a third exhibit showed the need for awakened interest in protection of wild life. This exhibit known as the "Forest Tragedy" was arranged by Captain Walter B. Sellmer.

Captain Sellmer's exhibit showed a beautiful spot in the forest, with a fallen doe and her two orphaned fawns, left to battle the elements without a mother's

protection. The scene is being viewed with a sorrowful eye by a hunter who has happened upon the wantonly and illegally slaughtered doe, while in search of game. With its natural setting, with every detail worked out, the exhibit should have a restraining effect upon every hunter who shoots first and looks afterwards, or who deliberately violates the law to shoot a defenseless doe. This exhibit was first shown at the Marin County Fair last year at San Rafael where it excited much favorable comment. It was later shown at Palo Alto and aroused much interest there also. It is the intention of the Division of Fish and Game to turn this into a traveling exhibit to be shown throughout the state.

The exhibit of the Fish Culture Department this year was even more comprehensive than in previous years. Against a scenic background were shown all of the fish that frequent California waters. Troughs filled with fish from the state hatcheries and aquaria giving close-ups of the many denizens of streams and other waters of the state were given a prominent place. It was possible to trace the growth of trout from the small fry to the point where they really excite the interest of the angler.

Under the direction of August Bade an exhibit of all the birds being propagated at the State Game Farm near Yountville was shown. Superintendent Bade's display portrayed methods used in bringing the birds to the liberation stage and attendants were ready at all times to explain how the birds are hatched, fed and cared for in captivity so that they do not realize they are not in the wild state.

HOME GROWN DUCKS PLENTIFUL.

It should be good news to disappointed duck hunters of last season to hear that a fine group of home grown ducks were available when the duck season opened. The augmented water supply of last winter increased the breeding grounds for ducks a hundred fold. Several lakes, the bottoms of which have been used for agriculture for several years past, were flooded by spring freshets. In some instances, rising water destroyed the first nests but reports are to the effect that most of these ducks nested a second time. Tulare Lake and Buena Vista Lake, at the southern end of the San Joaquin Valley, contained sufficient water this past spring and summer to attract numerous ducks. Goose Lake in the northeast corner of the state afforded another fine breeding area.

NEW FILMS OF STATE GAME FARM SECURED.

During the month of August, a splendid series of motion picture films were obtained at the State Game Farm. At least three reels forming a feature picture will be available as soon as they are completely titled. A complete series showing the ring-necked pheasant from the egg to the adult bird and the planting was obtained. Although these reels will not be available for loan they will be shown in connection with lectures at schools, fish and game protective associations and service clubs.

THE SHAD IN OREGON.

The first shad to be introduced in the waters of the Pacific coast system were planted in the Sacramento River by the U. S. Bureau of Fisheries in the early eighties. Conditions were most propitious for the survival of this famous eastern fish and it soon multiplied in numbers sufficient to spread throughout the Sacramento River system. In a few years the other streams of California became stocked with shad and it was not long before its appearance was noted in Oregon waters.

During the season of 1926 more than 1,500,000 pounds of shad were taken from the Columbia River. This is positive proof of the success the shad has had in adapting itself to northern conditions. It further discloses the fact that the shad is of very real commercial value to the Oregon fishing industry.

"Shad," states *The Oregon Sportsman* (Vol. 3, No. 5) "are native to the streams of the Atlantic coast. For many years they were caught in very large numbers in those streams and while the demand was always good the catch was large without restriction and the price was low until the last few years. Now, however, the purity of eastern streams has been destroyed by industrial wastes and city pollution to such an extent that the run of shad has almost entirely disappeared. This is notably true in the case of the Hudson, formerly probably the most famous of all shad streams in the United States. As a result, shad have become so scarce in the eastern market as to constitute a delicacy. Served in the cafes and restaurants the flesh of this fish is considered a choice morsel and commands a large price in all the markets."

Now the eastern states obtain the greater amount of their supply of fresh shad from California. Last year over 50 carloads of iced shad were expressed east from San Francisco. Thus far Cali-

fornia has enjoyed a monopoly on this feature of the industry, for the reason that the Oregon operators have canned all their catch.

DEER VIOLATOR APPREHENDED.

The inclination to destroy life is still a more potent urge in the minds of some than the intelligent application of the laws calculated to conserve the mother stock of game and the newly born. Hunters can yet be found who have no genuine sentiment for protected life. They shoot whatever has breath and harbor no desire to leave something for future generations.

Evidently the hunter who was recently apprehended by Deputy Theodore Benson in Humboldt County for killing a doe, a fawn and a spiked buck was a representative of this class who can see no value in the laws protecting game. He probably never reviewed the present in the future; never considered that game belongs as much to those that are to come after them as it does to those now living. He probably saw no importance in the law that would conserve an abundance of deer by protecting the does, their young and those young bucks that have yet to learn to be wary of the hunter.

Deputy Benson was informed that this "so-called sportsman" was likely to violate the deer law and apprehended him as he rode into camp with a fawn on his horse, followed by a woman carrying a doe on her saddle. When caught red-handed the violator tossed the carcass of the fawn into a gulch, leveled his gun at the deputy and then thought better of the matter. When brought before Judge Robertson of Fortuna he was sentenced to serve 100 days in jail or pay \$200. Needless to relate, the ideas that this violator now entertains about the laws for the protection of game are less vague and indefinite.

SCOUT SERVICE TO WILD LIFE.

The Permanent Wild Life Protection Fund, through Dr. William T. Hornaday, Trustee, and also former director of the New York Zoological Park, awards a gold medal to any member of the Boy Scout organization who shall during a given year demonstrate to the National Court of Honor that he has rendered valuable service of a quality satisfactory to the court in the conservation of wild life.

Valuable services to wild life may be rendered in the following ways:

1. By actively supporting laws and law officers for the protection of birds, quadrupeds, and fishes. Report immediately

to game wardens or policemen all violations of wild life protective laws, make formal complaints against violators, and give testimony at the trials. In this every father or big brother should back up the scouts.

2. By securing the support of members of legislatures and Congress for bills intended to enact better protective laws. Boy scouts can wield immense influence in this direction if they will! Combined effort is the key to success.

3. By securing the support of schools, or forming clubs, for the protection and increase of wild life.

4. By preventing, or punishing, nest robbing and song-bird killing by boys who have not been taught to protect wild life.

5. By addressing schools in behalf of wild life protection, and writing school essays on the rights of birds, the value of birds to man, the duty of boys to protect them, and the methods to be adopted.

6. By securing five-year close seasons for species of birds or quadrupeds that are locally becoming extinct.

7. By encouraging farmers to "post" their farms against all shooting.

8. By helping post notices of new protective laws.

9. By establishing bird sanctuaries.

—*Wild Life and Conservation.*

A NOVEL TYPE OF DUCK REFUGE.

Everywhere throughout the United States are duck grounds that are "shot out." These areas are idle and are serving no purpose either in supporting or raising ducks. Duck hunting enthusiasts are inclined to look on them with mingled feelings of regret and disappointment and sadly to recall memories when they were haunted by teeming numbers of migratory wildfowl.

However, there is little need for such pessimism. New Mexico has solved the problem of making the sport of duck shooting perpetual by means of a unique system of refuges. Along some 125 miles of the Rio Grande extends a series of sanctuaries alternating with public shooting grounds. In these protected areas the ducks take refuge when relentlessly bombarded by hunters in the course of their flights up or down the river. Here they are unmolested and find rest and food. Others that would otherwise continue on their journeys are induced to join them. Thus, by means of this unique system ducks are attracted and held in an area that would be barren of their presence without it.

"There is very little doubt" writes Aldo Leopold in *American Forests and Forest Life* (Vol. 32, No. 389), "that ducks would have been largely 'burned out' of the middle Rio Grande Valley by this time, but for the protection offered by the refuges. They would go right on through to Mexico, and instead of several months of shooting, the local sportsmen would enjoy only a few days of shooting during the main flights."

In summing up the efficacy of the system, Leopold says, "The local hunter is benefited because he has a place to shoot and at least a chance for something to shoot at. If he is a club member, he gets a chance at the birds which tend to 'trade' from the refuge to his club. If he is not a club member, he gets a chance at the birds trading between the refuges on the river or between them and the other public grounds.

"The general public is benefited because a whole river valley has been kept out of the class of idle 'burned-out' land, and kept in the class of usable winter range for waterfowl. Also, the number of local breeding ducks has been greatly increased, and thus made to contribute to both the local shooting and that of other points south."

PUBLIC SHOOTING GROUNDS SUGGESTED.

My idea of a sportsman is one who is willing to give a square deal to everyone, including the game hunted. Is it unsportsmanlike, I wonder, for the owner of land, who derives his living from the soil on which he pays taxes, to deny to others the right of enjoying it temporarily? Most of those who own offices or homes in the cities would be unwilling to let a rancher enter on their property and commit an act against their wishes. I am a land-owner and have had my house peppered with shot, my stock killed, my fences pulled down. I have suffered damage from fires started by hunters and at times have been brought to the point of looking with disapproval upon the unsportsmanlike character of those who are careless or disregarding of the rights of the land-owner.

However, I realize the genuine pleasure afforded to a vast lot of men who go hunting. With the increase of automobiles that take the city sportsmen out into the country, the problem grows every day. Certainly a solution might result if the state would furnish these landless hunting enthusiasts with places on which to hunt. Big tracts of land could be purchased in the different counties, game refuges established on them, and a charge

made for their cost and maintenance in the form of a license. In this way the landless chap could be satisfied and the rights of the land-owner less open to infringement.—H. E. Ellery, Oceanside, California.

FLOATING REDUCTION FACTORIES.

(Vol. II, No. 311.)

According to *Science Service*, "The most novel development in floating fish factories is that of the 'Calgary,' a French vessel of over 2600 tons. This vessel is being provided with powerful refrigera-

it is proposed to operate the vessel off the west coast of Africa it has been suggested that the vessel may visit Iceland, Greenland and even North Atlantic fishing banks adjacent to our own coasts.

"The power of science in making far distant resources available is well illustrated by these developments. Unless subjected to proper international control, these same developments may encompass the ruination of important aquatic resources and leave us poorer than before.

"The menace still remains, and unless some form of international cooperation



FIG. 67. Basketful of young ring-necked pheasants just out of the incubator. State Game Farm, July 17, 1927. Photograph by Sidney Snow.

tion equipment and three large cold storage compartments with a capacity of 800 tons of fish. There are six retorts on board. One will be used for cooking lobsters and crayfish; another for making gelatin; two, capable of handling 40 tons of fish and fish waste per 24 hours for conversion into oil and fertilizer; and two others with a capacity of five tons each for the steam extraction of oil from the livers of sharks and rays. There are two oil storage tanks, one of 26,000-gallon capacity for storing fish oil and one of nearly 400 gallons for liver oil. Although

is evolved we may have another 'rum row' off our coasts busily engaged in mopping up the fish supply with utter disregard of the needs for conservation and bootlegging the manufactured products into any port where they can find safe entry.

"California authorities have constantly striven to restrict the amount of sardines—so abundant off their coast—which shall be used by the reduction plants for conversion into oil and meal. This has been done so that the great sardine canning industry may * * * become a per-

manent state industry, which is now producing more than a million cases of canned sardines per annum."

A BRIEF FOR THE CORMORANT.

The ill feeling that fishermen bear toward the cormorant springs from the belief that the bird is responsible for the scarcity of fishes. Fishermen and anglers have witnessed scenes in which the cormorants have caught fish and have made a sweeping condemnation of the whole family. But this prejudice is due to lack of discrimination and understanding. As is usual in such cases, investigation and careful examination of the inter-related circumstances prove that the cormorants are unjustly blamed.

"Cormorants are among the best friends of our fishes," writes Arthur H. E. Mattingley in the recent July-August *Condor*. In fact, "they assist in keeping up a supply of fishes," he asserts, "for the use of man." Nor has the cormorant such a "voracious appetite, as some persons suggest when they condemn the bird."

In proving his case, Mr. Mattingley continues as follows: "Most of our fresh water fishes spawn in places where there is some cover or protection for their ova, which is usually deposited among the vegetation in swamps or back-waters, where there is a gentle current flowing or rather filtering through, or in streams among the water weed and other aquatic growths that prevent it being swept away into the swifter parts of the current; also the ova may be placed under logs and stones. On account of the immobility of the ova, it is readily preyed upon from below by many kinds of crustaceans, such as yabbies (crayfish), while water tortoise and eels and other fishes dispose of vast quantities of it as well as myriads of the small and almost helpless fish fry. Statistics collected by expert pisciculturalists and ichthyologists indicate an astounding mortality among the fish ova and fish fry, to an extent almost incredible. The small number of fish that arrive at maturity is out of all proportion to the number of ova deposited. This dire mortality is due to the enemies of the ova and fry, and, if the enemies are not held in check, then there is a serious diminution in the available supply of mature fish. To destroy those creatures that prey upon the enemies of the fish ova and fry is tantamount to destroying the fish themselves, and in the destruction of the cormorants this procedure is exempted.

"Special observations made by me at the cormorant rookeries situated on inland waters show that they feed their young

almost entirely on yabbies (crayfish), frogs, shrimps and young water tortoise. One must remember that at this period the swamps, particularly in the Murray River basin, the greatest waterway in Australia, are annually inundated, and what is dry land for part of the year is then covered with water. It is at this period that the large and mature fishes retire from the main stream and deposit their ova among the aquatic vegetation of the swamps. Crustaceans of many kinds repair also to the swamps at this time, and prey upon the ova and minute fry in appalling manner, billions of either fishes' eggs or young fishes disappearing into their hungry maws. Water tortoise likewise lay their eggs in the sand adjacent to the swamps, so that their young, when hatched out by the solar heat, can readily find their way to them and banquet upon the bounteous supply of fish eggs and fry.

"It is precisely at this period that certain species of cormorants, namely, *Phalacrocorax ater*, *P. fuscescens* and *P. carbo*, nest together in rookeries in these swamps, well knowing that an abundant harvest of crustaceans is to be reaped from them at this time. The instinctive knowledge of this fact is a necessity to them, since their energies are taxed to their utmost to satisfy the voracious appetites of their young ones. At this period there are no fish of suitable size, such as is commonly captured by cormorants, to be found in the swamps; with very few exceptions, only the large spawning adults are to be found. It is obvious that the destruction of fishes by cormorants in these localities does not occur at the nesting period, cormorants disdaining the capture of the small fry when there is a plenteous supply of larger size and more readily captured, slow-moving forms of life suitable as food for their young ones. Hence the cormorants at this period allow more fish to be hatched out than are eaten by the adult birds throughout the balance of the year, when they prey upon them in their more advanced stages of growth, and when the fishes have a better chance to escape.

"Owing to the small size of the ova of fish, a crayfish can easily dispose of 1000 of them each day, and if we take the spawning season, that is, the period that spawn is available, as thirty days, we have a total of 30,000 of potential fishes destroyed by one crayfish in a season. If we again take into consideration the fact that a cormorant captures ten of these crayfish for each of the thirty days, we have the enormous credit to the cormorant's account of 300,000 ova that have

the chance of hatching. Now if we take the quantity of fish a cormorant could devour daily as six and multiply it by 365 days of the year, we find that a cormorant could dispose of only 2190 fish per annum. The total yearly credit in favor of the cormorant is thus 297,810 fishes: truly a splendid credit balance! It is during the nesting period the cormorants and their young are destroyed wholesale, owing to their being more easily approached at this time—a time at which their usefulness is greatest.

"Erroneous ideas are rife as to the quantity of fish that a cormorant can consume. Some persons assert that these birds eat as much as 21 pounds of fish daily. However, when their assertion is investigated it is found to be only conjecture. The digestive power of a cormorant is regulated by the bird's size; and the quantity of food demolished at one meal by a bird of a given species varies according to the size of its gullet, which limits its capacity for swallowing, being greater in the larger species than in the smaller. In dealing with the voracity of cormorants I might state that one hears most extravagant statements made in regard to their gluttony which, when investigated, prove to be old shibboleths more or less enlarged by the present generation and to which credence is readily given.

"As an illuminating instance I may be permitted to mention that on one occasion I engaged in conversation with a representative appointed by a fishermen's association, whose members depend on catching fish for a living. In reply to my interrogatories this fisherman stated that cormorants were able to kill and swallow fish up to 7 pounds weight, and to eat up 21 pounds weight per day; and that the cormorant could digest a fish in a few minutes. A bird was shot and identified by him as the species referred to (*P. ater*). This bird was placed on a scale in his presence and it weighed 2½ pounds. When asked if he still maintained that a bird whose total weight was 2½ pounds could engulf a 7-pound fish, he said that he had never thought of the relative proportions of the bird and the fish before. When further pressed to produce evidence that a cormorant could devour 21 pounds weight of fish per day, and asked to consider the fact that man himself consumes barely 3 pounds weight of food per diem, he stated that his knowledge was mainly obtained from stories which were in circulation when he was a boy and, although he had observed cormorants catching fish

almost daily, he had never supposed these stories to have been incorrect."

HOW DUCK SUPPLY MAY BE INCREASED.

The pens of many conservationists have paid considerable attention to the problem of protecting and perpetuating migratory wild fowl. It is acknowledged that reduction of bag limits alone will not affect a solution. Some even go the length of maintaining that bag limits are of minor importance. However, nearly all are in agreement that food supply is vital to the problem.

Jack Miner, a pioneer in the duck sanctuary idea, fed over 4000 bushels of corn in the spring of last year to migratory wild fowl that had been educated to come to his home.

"One of the complaints," he writes, "I have heard is that the ducks' breeding grounds are destroyed. Such nonsense! There are breeding grounds in America for 99 per cent more ducks than we have. The only reasonable complaint for us not having ten ducks where we now have one is hinged on their winter quarters. We can overcome all of this by feeding. In this way we can move them from all polluted streams and stagnant lakes, which at the present time are killing our ducks by the hundreds of thousands. Feed them in marshes and lakes where the water is pure. * * * We feed to bring them to our guns, then why not feed to protect them?"

"Any bird," he continues, "that is intelligent enough to fly one-half mile from humanity for self-preservation that bird will fly clear across the continent back and forth to us for food and protection. Knowing this, we must no longer treat these birds as wild, but as migratory chickens, and let each county establish a small federal sanctuary of not less than twenty-five nor more than one hundred acres near the center of the county. This should have a dog-proof fence around it and no shooting allowed within a mile of this fence. I just mention the above as an outline, but local conditions are, after all, the determining factor and, if you have no local conditions, do as I did—make them. Plant a forest border of evergreens from four to ten rods wide all around the outside. Now liberate a few pairs of winged tipped pinioned wild ducks and geese in there, and feed and protect this haven of rest and watch results. In a few years you will find your sanctuary a stopping place for thousands of our migratory chickens, with many other species making their home in

the evergreens. In seedling trees I planted twelve years ago, there were at least 300 occupied mourning doves' nests at one time last summer. The overflow of such sanctuaries will spread all over the county and soon our bird life will be more evenly distributed throughout the nation. * * * The plan is not a joke. It has been tested out and the opportunity is pounding at the door of every county. We can bring these honking V-shaped waving lines of birds down into our little lakes, rivers, or even in artificial mud holes and have them with us for at least two months twice a year, or we can let them continue to migrate over a mile high. This is left entirely with us."

[Quoted in part from "*The Unfinished Migratory Bird Treaty*," by Jack Miner.]

STRIPED BASS GAINING IN PUBLIC FAVOR.

That many are becoming interested in the life history and habits of the striped bass is evident from recent articles appearing in various periodicals. An interesting review of striped bass fishing is contained in the *Maryland Conservationist*, and a report on research on the age and rate of growth of striped bass appears in the *Zoological Society Bulletin* (29, 6, 1926, pages 210-211). The latter article gives two interesting graphs made from data collected by members of the Asbury Park (New Jersey) Fishing and Gunning Club in 1924 in connection with work taken up by the Committee on Cooperation with the Bureau of Fisheries, of the Association of Surf Angling Clubs. Records of weight, length, sex, date of capture and samples of the scales were secured for thirty-five specimens. Three heavy fish, weighing respectively 38½, 34 and 39½ pounds are grouped under age 13. The curves represented in the graph show a fairly smooth curve for both females and males.

TRUMPETER SWANS SURVIVE.

Not long ago the trumpeter swan came near being listed among the extinct species of North American birds, and while it can hardly be said to be far from the ragged edge of extinction, it does appear to be gaining ground here and there. Edmund J. Sawyer, Park Naturalist at Yellowstone National Park, reports that the swan presumably breeds in the park, and appears to be increasing there, although only one pair of nesting birds has been found.—*Nature Magazine*, December, 1926.

FUR FARMING IN BRITISH COLUMBIA.

The economic value of fur-bearing species of mammals is being more keenly felt with the dwindling of their numbers in the wild, and attention is being directed toward their propagation. Fur farms are on the increase in areas where conditions are favorable for their existence. In British Columbia, for instance, there were in the neighborhood of only ninety-five fur farms in 1920.

Now comes information from the Provincial Game Warden, J. H. McMullen, that at present there are 350 fur farms. "The fur farmers are farming silver, black, blue, red and cross foxes, as well as beaver, fisher, marten, mink, muskrats, raccoon, weasel and skunk. From the returns submitted covering the operations of these fur farms to August 31, 1926, I find that the following animals are being raised in captivity or otherwise: Foxes—silver, black, blue, red and cross, 2804; beaver, 108; fisher, 16; lynx, 3; marten, 82; mink, 552; muskrat, 3040; raccoon, 76, and skunk 8. The figures given in respect of muskrats and beaver are only approximate as in many cases the fur farmers are farming these animals in the wild state and it is impossible for them to give a correct estimate of the number of animals on hand, and consequently they have only furnished approximate figures."

STATE GAME REFUGE REQUISITES.

State game preserves are to be acquired by the Department of Conservation of Michigan, under the direction of Director Lee Young. Specifications for these preserves were prepared by C. R. Lovejoy, head of the game refuges division, who was largely instrumental in the initiation of the land economic survey in Michigan. They are designed for the available lands in the state of Michigan, but are applicable to wild life conservation problems elsewhere.

To be most effective and prompt in increasing game the preserves should be located in large areas of wild land, having fair to good cover, so that the increase may spread out from the preserves and occupy surrounding territory without interference; they should be on relatively fertile lands, with a variety of natural and introduced wild life food supplies; and they should include plenty of winter cover (usually cedar swamps in Michigan) and should have rough hardwood as well as pine land adjoining.

Such preserves, it is recommended, should have generous supplies of living water; should be located and laid out to

make fire and other protection practicable at low cost; and should have a fair stocking with wild life, especially partridge and deer, so that artificial stocking will not be needed.

A standard preserve should contain a centrally located, permanent refuge or sanctuary, posted and marked with a strand of wire, to contain not less than four to ten sections (2500 to 6500 acres) while surrounding the refuge there should be a zone of state-owned land to be used as a public hunting ground, at least a mile in width, so as to make the total acreage (refuge and hunting ground together) 10,000 to 18,000 acres. Lands already owned by the state should be used as far as practicable.

Each preserve should have a resident keeper, a system of permanent fire breaks, intensive vermin control, and clearing and planting to insure adequate food and shelter.—National Conference on State Parks, Vol. 1, No. 7.

EXPERIMENTAL RABBIT FARM AT FONTANA, CALIFORNIA.

Fontana, San Bernardino County, California, has been selected by Secretary Jardine as the location of the new experimental rabbit farm, which is soon to be established by the Department of Agriculture in cooperation with the National Rabbit Federation and the Fontana Farms Company. The Bureau of Biological Survey, under a cooperative agreement with these two organizations, will finance the operation of the farm, and plan and conduct the experimental work to be done for the improvement of the rabbit raising industry throughout the country.

D. Monroe Green, associate biologist, who has been engaged in rabbit investigational work in the division of fur resources of the Biological Survey for the past two years, has been appointed to direct the experiments on the new farm and will leave Washington late in August to take up his new assignment at Fontana.

The farm will include five acres of land, on which will be erected an administration building, a house for the caretaker, a feed storage shed, hutches, and other necessary buildings to care for a large number of breeding rabbits. The land, buildings and other equipment will be furnished by the local unit of the National Rabbit Federation and the Fontana Farms Company. The purpose of the experimental farm is to develop reliable information for rabbit breeders and for those contemplating raising rabbits as to the best methods of breeding, feeding,

and housing these animals to produce both meat and fur of high quality. The cooperation of local and national organizations interested in the industry will be sought in conducting the experiments.

This will be the third experimental station to be operated under the direction of the Biological Survey, one being the Experimental Fur Farm at Saratoga Springs, N. Y.; and the other the Reindeer Experiment Station at Fairbanks, Alaska. California was selected for the rabbit farm because of the representative conditions there, Fontana being about 50 miles from Los Angeles, the center of the industry, and because more rabbits are at present being raised in California than in any other state. The results of the experiments at the new station, however, will be for the benefit of rabbit raisers throughout the country.

BIRD MINDING MADE EASIER AND CHEAPER BY IMPROVED METHODS.

At this season of the year migratory flocks of bobolinks (rice birds), which are protected throughout the year by the federal migratory-bird treaty act and which may be killed only under special permit of the Secretary of Agriculture, begin to take their annual toll from ripening crops of rice, milo, and corn. Flocks of blackbirds are also active on the same crops. Though this sort of damage may be considered local in character, depending largely on the presence of nearby marshes or lakes that attract the birds, it frequently may result in serious injury to standing grain. In the few remaining rice fields on the South Atlantic coast, bobolinks still are destructive to this grain in the "milk" and "dough" stages; on the Gulf coast of Louisiana and Texas red-winged blackbirds are a menace on the southern borderline of the rice area, and in the rice fields of the Sacramento Valley and the milo fields of the Imperial Valley of California, these birds must be combated annually at a considerable expense to the farmer.

During the past year the Biological Survey of the United States Department of Agriculture has experimented with the use of small-bore rifles in place of shotguns as a bird-frightening measure in large grain fields. Though this method is by no means a new one in the West, its utility has not been previously demonstrated in the rice fields of the South Atlantic and Gulf coasts.

By using "long rifle" cartridges in a .22 caliber rifle in place of the shotgun it has been found that the ammunition cost of bird minding can be reduced to

about one-fifth. The longer range of the rifle permits individual bird minders to patrol correspondingly larger areas, reducing labor costs to about one-fourth of that ordinarily expended for control with the shotgun. In addition, both bobolinks and red-winged blackbirds respond more readily to the impact of a rifle ball than to bird shot and are more inclined to leave the fields.

For convenience in reaching all parts of the field, a shooting tower 15 to 20 feet tall built of scantling may be erected near the center of the area to be protected. This permits the bird minder to see where he is shooting and direct his shots downward into the water or soft mud of the rice field.

Although this method can be used only

in large fields away from buildings and live stock and where the bird minder has a clear vision of the surrounding country, it has decided advantages over the old method. Furthermore, by substituting the rifle for the shotgun the actual work of bird minding is changed from an exhausting, nerve-racking, and often hopeless occupation to one that under some conditions may be considered leisurely and even pleasant.

It must be emphasized, however, that bobolinks, or rice birds, which are protected by federal law, may be killed only under special permit of the Secretary of Agriculture. Rice growers may make applications for such permits to the Biological Survey of the United States Department of Agriculture at Washington.

COMMISSION ACTIVITIES.

Department of Patrol.

Twenty-eight deputies have been added to the staff of patrol. Others will be put on the force as the new budget permits. The new deputies have been located in those portions of the state that have been more or less neglected in the past and where a law enforcement officer was greatly needed. The new men have been carefully selected. All range from 25 to 40 years of age and most of them are in their thirties. They have the energy of youth, yet are better balanced than younger men, are in good health and have that enthusiasm tempered with judgment that comes from a realization of the importance of their task.

To make possible more effective administration of field activities, by coordinating the work of the captains of deputies, two offices, bearing the title of "Assistant Chief of Patrol," have been created. A number of deputies have been promoted.

M. S. Clark, for many years in charge of the San Francisco patrol force, has been promoted to the post of Assistant Chief of Patrol. Captain Clark will have all the territory north of the Tehachapi. In addition to harmonizing the work of the captains in the northern counties, he will have supervision over the unattached deputies, or those not assigned to captains.

Captain Clark has served the Commission ably for sixteen years. While special agent for the Pinkerton National Detective Agency he chanced to visit the Mt. Shasta Hatchery and became so interested in the work of the Commission that he

succeeded in becoming a deputy on August 21, 1911. His training and record of achievement well qualifies him for his new position.

Charles S. Bauder, for the past few years in charge of the Los Angeles office, and since January, 1926, ranked Captain of Patrol, has been promoted to the other post of Assistant Chief of Patrol. His district embraces the counties of Ventura, Santa Barbara, Los Angeles, Riverside, Orange, San Bernardino, Imperial, San Diego, Inyo, Mono and Alpine. Captain Bauder served as a technical assistant in the Commercial Fisheries Department before his appointment as a deputy on October 1, 1914. He has shown marked ability to handle men and has disposed of the many perplexing problems of a large and difficult district in a successful manner.

Four deputies have been made captains. Meritorious and faithful service during many years has gained for them this distinction and it is reasonable to assume that these men who have been advanced will be able to exercise their abilities to better advantage in their new positions.

Captain J. O'Connell will have charge of the deputies in Calaveras, Amador, San Joaquin and the southern part of Sacramento counties. His promotion comes after ten years of creditable service.

Captain Walter Sellmer will have the supervision of the deputies in Marin and Napa counties and the commercial fishing waters of Solano County. This appointment is fortunate as Captain Sellmer's enforcement experience extends to both land and sea.

Captain Edward H. Ober, the "desert deputy," has been with the Commission since September 15, 1908. He will have Alpine, Inyo and Mono counties.

Captain Edward Ricketts is also an oldtimer, having been appointed a deputy on October 1, 1910. He has been given a large district in the southern part of the state.

Many hunters were scattered everywhere throughout Inyo, Mono and Alpine counties (district 4½) on the opening day of the sage hen season. All sorts of makes and models of guns were in evidence, and the welfare of the sage hen appeared at first rather gloomy in view of this tremendous activity. Fortunately,

July 29 requires a bond of \$2,500 for all nonsalaried deputies serving the Commission. Owing to this and other provisions of the law, it was necessary for the Commission to cancel the appointment of all dollar-a-year deputies and to require new appointments.

As in the past an application must be signed by the president and the secretary of a bonafide fish and game protective association or club and the applicant must be endorsed by the captain of patrol of the district in which he resides. As it was necessary to require a \$5 fee accompanying the filing of each nonsalaried deputy's bond, arrangements were made to return this sum to each newly appointed deputy in the form of payment



FIG. 68. Native valley quail in breeding pen. State Game Farm, July 17, 1927. Photograph by Sidney Snow.

not nearly the number of birds were killed this year that were bagged last year. Due to the restricted private holdings of the Eaton Land and Cattle Company, few birds were shot in the Long Valley section in Mono County. So long as hunters are excluded from this section, the bird will be in no danger of extinction.

Throughout the district, every principal road and trail was covered and hundreds of licenses checked. Two hunters were apprehended: one for hunting sage hens before the season opened and the other for an over bag limit. The former paid a fine of \$50 and the latter one of \$25.

The recent law which went into effect

for his month's services. Such services, however, are to be voluntary after this first month and no compensation is to be rendered whatsoever.

Nonsalaried deputies are required to file a monthly report of their activities. This is done not so much for the reason that many and frequent arrests for violations of the law are expected, as the desire on the part of the Commission to know what is being done each month for the cause in which the sportsmen and the people of the state are very much interested. The reports, in the main, contain the conditions observed afield and astream, and include notable increases or decreases in the supply of fish and game, the results had from the planting of fish or game, the

flow of water in the streams at various seasons of the year, or any other matters that are considered to be of interest or of value to the cause of wild life protection and conservation.

For the three months ending September, a total of 566 arrests have been made by the patrol force and fines aggregating \$22,320 imposed. Nearly 9500 licenses were checked by the regular deputies.

Justice Ray Baugh fined a Monterey man \$150 for having deer meat in his possession in closed season. Deputy Fred H. Post made the arrest.

A San Francisco "crab bootlegger" was caught by Captain Henry Lencioni and Deputy J. H. Groves in his attempt to smuggle six dozen crabs out of Humboldt County. Judge M. T. Vaughan of Santa Rosa fined him \$100.

A commercial fisherman, Tomas Briggante, was fined \$150 by Judge Herman Rudolph of Novato Township, Marin County. The violator had used a net two-thirds illegal under the law to take six black bass. He was unable to speak English in spite of the fact that he had resided in the state for twenty-seven years.

Deputy C. J. Walters refused to listen to a Hollywood angler who insisted that he could fish on a hunting license. Judge A. E. Rule of Mono Lake, after hearing the story, assessed the angler \$25. Evidently such delusions are severe with the pocket-book.

Working on a hunch that an old offender, Peter Bollesteri, was catching striped bass with a net during the closed season. Captain Sellmer observed the fisherman's operation from a concealed vantage point and succeeded in apprehending him with two sacks full of bass. A fine of \$100 was imposed by Judge Helmore.

The many-sided abilities of a deputy and the resourcefulness of the field forces of the Commission when acting in concert has been demonstrated again. Recently it was necessary to drain a large pond near Encina and some 4000 blue gill fish of all sizes were in danger of being stranded. Captain Ed Ricketts and Deputies Carmi Savage and R. J. Sadler were organized into a rescue expedition. It is reported that Captain Ricketts rushed down to the Commercial Fishery Office

at East San Pedro and borrowed a seine. Deputy Savage talked to one of the leading creameries and secured 20 milk cans, while Sadler got in touch with a Pasadena sportsman who furnished a truck.

Fully equipped and clad in suitable clothes, the men advanced on the lake and seined out the fish, placed them in the cans, loaded the truck and were off for Hughes Lake, sixty miles north of Los Angeles. The loss of fish was negligible, which all goes to show that the name "minute men" often applied to the field forces, is justified.

The results of fish planting operations have almost exceeded the most sanguine expectations and work throughout has been marked with the most sincere spirit of cooperation and willingness on the part of all those concerned. On June 28, the first car of fish, 250,000 Loch Leven, was shipped from the Mt. Shasta Hatchery. The fish were taken from Suisun directly to the Gordan Valley Reservoir and planted. By September 1 car No. 1 had made sixteen trips from the Mt. Shasta Hatchery and Fort Seward Hatchery. On each trip approximately 200,000 to 250,000 fry have been transported for planting.

On July 8, car No. 2 started from the Mt. Shasta Hatchery and it had made thirteen trips up to September 1, delivering about 225,000 fish each trip.

In early July, the water in the North Creek Hatchery dropped considerable and it was necessary to move the fish. Accordingly, planting started earlier than usual and approximately 500,000 fish were planted in San Bernardino, Riverside, Los Angeles and Orange counties from this station.

Messenger shipments have been going forward from Fort Seward Hatchery to the streams in Humboldt and Mendocino counties. These shipments have been mostly of steelhead fry; a total of about 1,190,000 fish.

Some planting has been done of fry from the Tallac, Wawona and Kaweah hatcheries. Truck shipments started from the Mount Whitney Hatchery in July to make room for golden trout eggs which, due to snow conditions in the high Sierra, were obtained late this year.

A plant of 500,000 trout fry with but a loss of one-half of 1 per cent was made in July in the southern district under the supervision of Captain Ed Ricketts.

The deputies in charge of the work and the men under their direction labored night and day until the plants were com-

pleted. In each instance trucks were furnished by the county supervisors and ice was supplied by the counties and sportsmen's organizations. Thirty-seven plants were made in San Bernardino County, seventeen in Los Angeles County and eleven in Riverside County. The work was started on July 6 and wound up on July 22.

Two plants of exceptional difficulty were made. It was necessary to transport one allotment on pack animals for eleven miles in order to place the fry in Prairie Fork in Los Angeles County. The pack animals met the trucks at Los Angeles County Park near Cajon Pass, and carried the fish over the old Santa Fe Trail. The planting was started at 3000 feet elevation, the deputies working up to 8000 feet and down again. Despite the difficulties of such a long pack, but 100 fish were lost. The men worked for 36 hours straight.

In order to properly distribute 20 cans containing 20,000 fish along Big Bear Creek in San Bernardino County, the deputies were forced to lower the cans on ropes down a 110-foot cliff and pack the loaded cans on their backs for a quarter of a mile. But 20 fish, one to a can on an average, were lost in the planting.

In spite of the many details requiring attention in this plant, the deputies found time while planting the fish to arrest 13 persons for violation of the fish and game laws. All arrests were made for taking undersize fish or for failure to have an angling license. Nor was any duty neglected in rendering these arrests complete.

One prominent Los Angeles business man attempted to ride rough shod over the deputies when asked for a license. The next day this angler purchased a license and attempted to talk the agent into dating it back a day. When this fact was brought to the attention of Justice of the Peace C. R. Lynn at Pine Knot, he assessed a fine of \$35 against the offender. This is \$10 in excess of the usual price of such derelictions.

The fines totaled \$300, and ranged from \$25 to \$40.

Department of Fish Culture.

All in all fish propagation has had a successful year. In a few instances the water was abnormally cold in the hatcheries, thus retarding the growth of fish. In all of the hatcheries fish are being held as late in the season as possible in order to age.

Holding tanks are being installed at a

number of the hatcheries. At Yosemite Hatchery and at Lake Almanor holding tanks which will cost several thousand dollars are being built. This will make possible the holding of large numbers of spring spawned trout until winter and yet facilitate the cleaning up of the hatcheries in preparation for the fall spawning trout.

A number of improvements have been recently made at the Mt. Shasta Hatchery where more than 9,872,000 trout were awaiting distribution on July 1. A new hydro-electric plant now furnishes light and power. A refrigeration plant keeps the fish food in fresh condition. A new road has been constructed and the ponds put in first class condition.

By the end of July 2,800,000 trout had been moved from the Mt. Shasta Hatchery by trucks and railroad cars.

The 2,350,000 salmon held in ponds for liberation this fall are all in good condition and making a good growth.

In order to handle the cans of fish more easily one of the new trucks used at the Mt. Shasta Hatchery has been improved. The bed of the truck has been covered with sheet iron. Not only does this facilitate the handling of the heavy cans of fish but it also prevents damage to the bed as the result of water.

Klamath River spawning stations have been closed since the winter and numerous repairs will need to be made. Heavy freshets last winter destroyed some of the concrete work at the Beaver Creek station.

Installation of the racks of the Klamathon Spawn Taking Station was completed at the end of June looking toward the fall salmon run. The high water of last winter and spring washed out many of the rocks used in ballasting the racks and considerable difficulty was experienced in securing the necessary amount of rock.

The Rae Lakes Egg Collecting Station closed the season on July 24 with only 60,000 rainbow eggs to its credit. A crew left Independence on July 21, but were unable to get over the summit with the stock. They finally sent the pack and saddle animals back and walked in with their packs and provisions. It was necessary for them to cover about ten miles over the snow. Perhaps the heavy winter which kept the lakes closed until late in the season had something to do

with the difficulties experienced by the spawn takers.

As usual Wawona Hatchery gave considerable trouble the past season. The water becomes very warm at this station and although the fish make a rapid growth, considerable difficulty is had in keeping them in good condition. They were planted before the end of July.

At the Bear Lake Hatchery approximately 1,000,000 rainbow trout are being held for distribution this fall after frosty weather sets in and the bass have taken to deep water. This will give the trout all winter in which to live in the shallow waters of the lake without becoming the prey of black bass.

The water conditions at the Ukiah Hatchery have also been poor. Inadequate supply has made it necessary to repump the water which has passed through the troughs and use it over again. As soon as the new hatchery on Cold Creek is finished, eight miles away, it will be possible to transfer operations to this better located station. Cold Creek Hatchery has an abundance of water not affected by droughts or seasonal conditions.

Needs in the Feather River region call for the building of a large new permanent hatchery on the shores of Lake Almanor. Sufficient eggs could be supplied from the auxiliary stations.

The egg-taking station on Beaver Creek has terminated operations for this year. Fish are taken at this station in a trap placed at the top of a ladder that gives the trout the only method of passing the dam put in by the Commission. Reaching the trap, the fish mill around and then dash into a pipe that runs into the segregating and spawning house. Here the males and females are separated and the eggs taken and fertilized. The eggs are then transported into Mt. Shasta Hatchery for hatching.

High water and cold weather have been responsible for the notable poorness of the rainbow spawning season this year. The temperature of 32 degrees which prevailed early in the egg-taking season made the work almost impossible, while the high water kept the fish from coming up the creeks.

Splendid fishing has been reported from Lake Tahoe. The biological survey of the

region indicated that there is a great abundance of minnows and that the high water has brought the trout near to the surface. A number of Mackinaw trout are being taken by those who know that this fish is a bottom feeder and must be sought in deep holes of 400 feet or more.

Department of Commercial Fisheries.

The albacore season began during the latter part of June. These fish are all caught by hook and line. The oldest method is that known as the "Jap method" of catching them with hand lines and lines attached to bamboo poles. A newer method is that known as the "jig method" whereby a small boat trolls for them with a jig, in somewhat the manner of salmon trolling. It has become a custom for salmon trollers from Monterey, San Francisco and Pittsburg to go south and fish for albacore. Toward the end of June, most of the salmon trollers left these three districts for southern California.

There is still agitation directed at killing sea lions because of the current opinion among fishermen that they destroy valuable food fish and are a menace to the fisheries. A fund was started to furnish bounties but the plan has now been abandoned. Before the new law went into effect, giving protection to California sea lions in districts 19, 20 and 20a, a raid was made by some unknown person on the sea lions breeding on Castle Rock. Sea lions of all kinds and sizes were killed, the scalps taken and the rest of the carcass left to rot. If control seems best as shown by the present census and survey, then the animals should be taken in a scientific way and utilization made of the carcass. Otherwise the state is wasting a valuable natural resource.

According to the market men fish have been scarce at the wholesale markets, due to the few boats fishing for market fish. This generally is the case in July and August, since a great many of the regular market boats go after albacore and tuna.

As stated in the June report, the albacore season began toward the end of that month. The run of albacore, however, was short-lived, and throughout the month of July very few of these fish were taken. Most of the albacore jig fishermen from northern California have re-

turned and state that the season was an entire failure for them. This failure of the fishermen to get albacore in any quantity this season is likely to be very hard on the southern tuna canners in a financial way. Prices as high as \$300 per ton have been offered by some packers.

During the month, H. B. Nidever was appointed supervising captain and put in charge of the commercial fisheries patrol work at Monterey, which he will supervise in addition to the patrol in southern California. Nidever will also cover San Luis Obispo and cooperate with the game patrol of that county in the matter of enforcing the Pismo clam laws, in an effort to save that mollusk from extermination. The state car, a Studebaker, was turned over to Nidever to be used by him in his work of supervising the commercial fisheries patrol.

There has been a feeling on the part of sardine canners at Monterey that the sardine reduction act was not being enforced in the same manner in the southern part of the state as it is at Monterey. By adding the commercial patrol at Monterey to Nidever's duties, it is hoped that the objection will be overcome.

The work being done on barracuda is chiefly to determine the age and rate of growth by two methods, checking one against the other—age determination by examination of the scales and length frequency of the small fish. Throughout the summer months concentrated effort was made on observing the spawning season. Incidentally there were gathered data for a weight-length curve. Each of the above pieces of information is important in learning the merit of our present legislation which sets a minimum size limit, with a minor restriction as to gear during the spawning season.

Observation of the commercial catch of the so-called smelts—the large or jack smelt, the small or bay smelt and the grunion are being made, the object being to determine the proportion of each species in the markets at various seasons of the year. In addition observations have been made at the spawning time of the two smelts and the age at which the jack smelt begins spawning. Age of fish at spawning is known for grunion and is being worked out for the small bay smelt by Carl Hubbs of Michigan. Our catch records do not distinguish these three fish so that an estimate of the catch of each

is best made by observations at the markets.

Paul Bonnot has completed a survey of the seals and sea lions of the California coast. Commencing the first of the year, he surveyed the entire coast and took a census of all the known rookeries. He was aided in his work by Captain Engelke and the patrol boat *Albacore*. This information, which is both interesting and valuable, will be published in a future number.

A new law which became effective July 29 now permits the importation of fresh crab meat as distinguished from canned meat from without the state for sale at any time. Persons engaged in this business according to the law are required to furnish the Commission with a copy of the invoice covering each shipment and the dealer in California must have an original invoice in his possession when receiving the crab meat. No change has been made in the law affecting local crabs which may be sold in shell only. It is also unlawful to bring crabs into the state during the closed season, namely from July 31 to November 14.

F. H. Bell recently spent three weeks at the State Fisheries Laboratory doing laboratory work in connection with his fisheries research for the International Fisheries Commission between the United States and Canada. The department considered itself complimented to have a fisheries research worker of this caliber make use of the publications of its library.

The State Fishery Laboratory and office grounds at Terminal have been landscaped. The lot composed of beach sand was first filled with soil. Shrubbery was then planted, sidewalks put in, and finally a lawn planted, all of which sets off the buildings to good advantage and makes them attractive to the eye.

From time to time, when field work permits, material is collected for various investigators engaged in some special study. This is being done at present for Dr. Skogsberg of the Hopkins Marine Station. Considerable material was gathered also for Dr. Carl Hubbs of Michigan, who is working out local races of certain California fish, including some life history work. All of this work ultimately benefits the Commission. Occasionally rare specimens are picked up at the markets, but the policy has been to avoid building up a collection which would require a cura-

tor, and instead sending such specimens where collections already exist, viz, Stanford University and Los Angeles Museum. Several display specimens have been prepared for the Los Angeles Chamber of Commerce and similar show specimens for the benefit of the Commission's southern branch are being arranged.

Bureau of Education.

Plans for the coming year include the employment of school lecturers whose duty it will be to carry a message of conservation particularly to rural schools. City school systems provide nature study supervisors but most of the children in the rural schools get little instruction relative to natural resources unless the teacher happens to be interested.

An exhibit depicting a dead doe with a young fawn standing by, which was installed at the State Fair, was arranged as a traveling exhibit. It has been shipped to the Ventura and Fresno county fairs and will be sent to other county fairs where it will continue to remind the hunter that carelessness brings about such tragedies. Someone will be in charge to answer questions and to give instruction. Wherever possible lectures illustrated with motion pictures will be given.

The new library of the Commission now presents an attractive appearance with table, chairs and rugs. The walls are lined with metal stacks containing books and pamphlets. Back volumes of conservation magazines have been punched and cut ready for insertion in binders. Several valuable reference books have been obtained from old book stores and others have been ordered. A good working library for employees is the objective sought.

A new portable motion picture machine has been purchased in order that motion pictures may be made available to those where facilities are lacking. Out-of-the-way communities will be given a chance to view the educational pictures of the Division of Fish and Game. This projector fills another need: that of a machine affording a review of new and remodeled films.

The new Yosemite Hatchery has exceeded, in a sense, almost all expectations of the ends it would serve in an educational way. Huge crowds still persist in

visiting it. In fact, some 9000 persons received instruction and have shown an interest in the exhibits arranged for their edification. Colored plates of trout properly posted and labeled and small fish in vials have been decided attractions. A leaflet distributed to visitors has been very helpful.

The tendency for auto campers and picnickers to pick up young fawns, apparently lost, has been checked in the Sonoma district, according to a report. The publicity given the matter by the papers and by the schools as the result of the nature lesson issued by this Bureau which appeared in the previous issue of this publication, has assisted greatly in alleviating the problem. In fact, only one case has arisen so far in Sonoma County. In former years, it was common for such cases to run into the dozens.

Bureau of Game Farms.

The 1927 hatching season closed with the hatch of July 18, and June proved by far the busiest month in the history of the Game Farm. During June, 5000 eggs were laid and 3618 chicks hatched. Up to September 9, pheasants to the number of 3582 had been planted in various parts of the state. About 9000 in all will be planted this year. Liberations were made of both young birds capable of caring for themselves in the open and of five weeks old brooding stock with domestic mothers.

All the birds taken from the farm have been trucked out. They have been transported at night to avoid the heat of a day trip. The planting grounds have been reached early in the morning as a result of this plan. This enables the birds to get early breakfast when insect life is most sluggish and to settle themselves in cover for the day. Only two or three have showed ill effects and these only from some of the longest journeys.

Over 557 pheasants approximately five weeks old were planted four miles from Sanger on six different ranches along the Kings River bottom. The plant was made with the assistance of the Fresno County Sportsman's Club.

At the time of the liberation there was a considerable development of insect life going on. The birds seemed to sense this, were quick to find their way out of the coops and industriously to run down and hunt out the prized morsels. They were particularly effective in reducing the cut

worms that were doing damage to a vineyard near one of the places of liberation.

It is reported that a high percentage of the birds have survived. They are growing rapidly. The males are taking on color and leaving the pens. In fact, two ranchers have taken such an interest in the success of the plant that they killed off a colony of cats that failed to conform to ethical practice and turned to hunting the young pheasants. It must have occasioned pain to these ranchers to have destroyed their pets in order that the birds might remain unmolested.

In the recent liberation of 255 pheasants near Salinas the lead was taken by a pair of ringnecks raised by the Chief of Police of Salinas. As the covers were opened on the long line of crates, the

the juice ceased to flow an attendant was near by to rush to the rescue of the eggs. Now this matter is not left to chance.

An ingenious device, recently perfected by Superintendent Bade, allows twelve of the pens to be supplied with water at the same instant of time. This mechanical contrivance saves the work of an attendant, for it is estimated that it would take one man some eight hours to make the round of the Game Farm if every pen had its respective faucet to be turned on. The device cools the pens and irrigates the cover in addition to supplying water to the birds. By a simple twist the spray is converted into a fountain trickling water into the sandy drinking places arranged.



FIG. 69. Chachalacas, famous Mexican game birds, with young. These birds were successfully reared by John W. Classen of San Francisco.

Game Farm pheasants rose with a rush and immediately dashed for the cover of the trees and tall grass of Tembladero Slough. A large crowd watched the thrilling flight and a motion picture cameraman ground out several hundred feet of film.

Other liberations were made at Redding, Keyes, Chico, Marysville, Roseville and Woodland. The closed area in Napa County was planted twice.

Two automatic alarm bells have been installed at the Game Farm to protect the incubators in case the electricity which keeps them heated should be turned off. The bells operate off the power line and ring until attention is paid to the seat of the alarm. Fortunately once when

• Bureau of Hydraulics.

An exhaustive investigation of the oil fields both inside and outside the city of Huntington Beach has been made. Conditions were found to be very bad and complete reports which include specific cases of pollution in each case accompanied by technical descriptions and photographs of almost 100 individual wells have been compiled. An injunction suit has been filed naming seventy defendants. It is believed that the prosecution of this case will be effective in cleaning up this field.

Another survey was recently completed of the waters in Mono and Inyo counties.

Two weeks were spent in a careful and complete examination of ditches, screens and canals and locations were noted for fish screens and ladders.

On May 31, a pipe line operated by the Richfield Oil Company spanning Alamitos Bay between Huntington Beach and Long Beach, broke. Much oil was spilled on the water and over the adjacent territory. The company employed a crew to clean up shortly after the accident. Little was accomplished, however, until the bureau's attention was called to the matter and a method of cleaning up advised. Acting on this advice fifty men were put to work using shovels and spades and the oil soaked grounds and weeds were removed. The oil was cleaned from the water of the channel. Three weeks were consumed in all to correct the damage done.

Salmon are running again on the Sacramento River as a result of the completion of a new fishway installed by the Anderson Cottonwood Irrigation District. The dam maintained by the District at Redding prevented the fish from making their way up the river and reaching their spawning beds, and the completion of the fishway is a real step in the conservation of this valuable food fish. The completion of the ladder also ends a seven-year controversy. At first there was uncer-

tainty that the fish ladder would prove successful. This occasioned delay in its construction and in turn halted the run of salmon for a while. However, the difficulties encountered were surmounted. The high water and underground water were taken care of and the ladder, which is novel in type, is working and the salmon are flashing through the pools on their way up the river.

The fishway consists of a series of pools built of concrete and steel gradually rising from the bed of the river to the top of the dam at one side and accomplishes its object in a manner never before thought feasible.

Protection of the fish in Big River, possibly the only stream in California that is still extensively used for driving logs for milling purposes, has been successfully accomplished. A new fish ladder at the Hellgate dam on the south fork of the river operated by the Mendocino Lumber Company will afford this protection. The ladder is designed by the department and allows steelhead and salmon to pass up the stream. It is a pleasure to record that the Mendocino Lumber Company plans to go further in the program of conserving fish life. This is evidenced by their recent order for work to be started on another fish ladder at the north fork of the Big River at Higgen's Camp.

LIFE HISTORY NOTES.

PIKE AND TROUT.

The squaw fish or pike has been condemned as a feeder on trout. The basis for this rests very largely on hearsay as few fishermen have been actual witnesses to the destruction of trout by pike. Waters that have formerly been alive with trout have yielded trout no longer once the pike has secured a foothold in them. And on the basis of this observation, extensive destruction of pike has been heralded as a means of conserving trout.

A former issue of this publication suggested that an investigation of the relationship between the two fishes be made or that more light be shed on the subject before final judgment be passed on the pike. In answer to this editorial, Carl L. Hubbs of the University of Michigan writes:

"I have a little information on this point, obtained last summer from the two game wardens at Roseburg and Winchester, Oregon. According to them and to other local residents, the squaw fish (the

local species, *Ptychocheilus umpqua* Snyder, very similar to *P. grandis* of the Sacramento system) occurred by the thousands in the deep swift water of the North Umpqua, immediately below the dam at Winchester. They could be seen feeding voraciously on the small trout and salmon below the wheels, particularly on those which had been stunned by passing through the wheels. Those opened had these little salmonoids in their stomachs. Some of the squaw fish were seined out, but this method did not prove very thorough. Dynamite was then used, and the large squaw fish were killed by the hundreds with single discharges. When we examined the stream some time later in the summer, we found the squaw fish only moderately common, but caught some young and small adults, and saw a few large adults, some perhaps thirty inches long. Further information could perhaps be obtained from the local wardens (one in each of the two Oregon departments). I saw no reason to doubt their stories."

**DOMESTICATED MEXICAN
CHACHALACA.**

Several years ago I was presented with what I supposed was a pair of chachalacas. As male and female look exactly alike, it was necessary to wait until the season when they would commence preparations to rear their young. But I was disappointed when both birds began laying.

After a considerable period had elapsed, I succeeded in getting another bird through the courtesy of the manager of one of our large steamship companies. The order was for a male bird, and when this latter bird arrived my hopes ran high. It was larger and lighter in plumage than the other birds, and very tame. I anxiously awaited the coming breeding season. To my surprise the three birds began laying, and another failure had to be recorded. I might add here that the birds are not very particular as to where they lay. They often dropped their eggs while resting on a perch, with the result that they were broken. The size of the egg is quite in contrast with that of the pheasant. Large, rough grained and dull white, it sometimes weighs as much as four ounces.

Two of the hens died and I was left with but one bird which proved to be two years old. On December 24, 1925, I succeeded in getting two more birds. These fortunately were young, and, though identical in appearance, turned out to be mated. They went through the 1926 breeding season without any result. The old bird sat on her nest with three eggs under her for thirty days, and repeated this process three times, but none of the eggs were fertile. The new hen did not lay at all.

This year both hens laid. They began late, for the species usually commences in April. This season, however, the first egg was laid about May 10th. As the chachalaca have two broods during the breeding season, I therefore concluded that it was barely possible they might begin laying again during August. Usually one egg is laid every other day until three or four have been laid, when the bird begins to set. While the birds are setting, they often leave the nest for over an hour at a time, and the eggs become quite cold. Several times I had about concluded that there was but little hope of the eggs hatching. Evidently the very thick shell, while apparently cold on the outside, must retain sufficient heat to prevent the egg from becoming chilled during the time it remains uncovered. The male bird does not incubate. The period of incubation

is between twenty-eight and twenty-nine days.

One hen sat on three eggs and the other on two eggs. Three of this number hatched, but the other two were not fertile.

About an hour after the chicks were hatched, I was amazed to find them on the ground being fed by the parent birds. When first hatched the chicks resembled somewhat those of the golden pheasant. The tips of their bills were a dazzling white. This disappeared after a week's time.

The male bird broods the chicks as well as the hen; sometimes one chick would be found under the hen's wing and the other under the male bird's wing. The third chick hatched by the old hen was brooded alone. It was necessary to separate the two broods to avert a tragedy.

Both male and female feed the chicks by regurgitation and direct feeding. The little fellows soon learn also to eat from the ground themselves.

The mature birds always choose a place to roost well removed from the ground, nor do they change this habit when they have a brood. In the present case the nests were placed six feet above the ground. The very first night after the chicks were hatched the old birds called to them. As I had made no provision for this, it was necessary for me to construct a runway from the ground to the roosts. The chicks lost no time in using it and were soon nestling under the parents' wings. Such a procedure came natural to them.

In the wild, the birds are said to build these nests in a mesquite tree. No doubt the chicks readily reach any roost by hopping from branch to branch. In captivity this is impossible unless brush is placed in the pens.

The chicks learned to fly very soon and at three weeks had no difficulty in reaching the high roosts.

The information I have been able to obtain about the chachalaca from books has been rather meagre. One statement I came across was to the effect that the old birds left the young after they were ten days old. This may be true of birds under natural conditions, but is not borne out by those I have in captivity. The parent birds are still as solicitous for the welfare of the chicks after three weeks as they were the day they were hatched. In my opinion, both male and female are far more attentive to their chicks than are domestic fowl.

It is perhaps too soon to say whether the young birds will reach maturity. At

the present writing they appear to be getting along nicely. They were very wild at first but are gradually becoming tame.

On the whole, the chachalaca is a very interesting bird. One can hardly escape noticing its graceful movements, its very inquisitive and watchful ways. Always on the alert, it sets up a chattering or warning when strangers are about. After accustoming itself to domesticated life, it becomes very friendly.—John W. Classen.

EUROPEAN TROUT GETS OLDER SCIENTIFIC NAME.

In *Copeia*, No. 155, June 24, 1926, David Starr Jordan calls attention to the change in the scientific name of the Euro-

pean trout. Knowledge of this change is pertinent because the fish has been acclimated in the waters of California. According to the note, Linnaeus gave three names to the European trout in 1758: Swedish gray trout (*Salmo eriox*), the sea run trout (*Salmo trutta*) and the brook trout (*Salmo fario*). All of these are now considered a single species. Evidence is now at hand to show that Widgren, in 1862, grouped all of the varieties under the one species name of *Salmo trutta*. Under the rules of nomenclature, *Salmo trutta* has priority and therefore is the proper usage, unless it can be shown that some earlier author similarly grouped various varieties of European trout.

CONSERVATION IN OTHER STATES.

FISHERIES MERGED WITH CONSERVATION COMMISSION IN NORTH CAROLINA.

Final passage of the bill by the General Assembly to merge the State Fisheries Commission with the Department of Conservation and Development adds another division to this department and another angle of work to its program of conserving and developing the natural resources of the state.

The program of the Fisheries Commission consisting of the protection and conservation of the supply and the replenishment of the resource is to be carried forth vigorously under the direction of this department. An important part of the work of the department in connection with this great asset of the state will be toward advertising its value to the world.

Fishing is valuable, in addition to its commercial exploitation, as a sportsman's attraction, and one of the objects of the Department is to encourage the increase in the supply of game fish in the fresh water streams of the state.—*Natural Resources*, Raleigh, N. C., March 1, 1927.

KAIBAB DEER NUMEROUS.

A brief winter investigation of conditions affecting the deer on the Kaibab National Forest in northern Arizona has just been completed, in continuation of studies of the Kaibab deer problem that have been in progress since 1922 under the direction of the Biological Survey, United States Department of Agriculture, in cooperation with the Forest Service of the same department, and the National Park Service of the Department of the Interior. The present investigation indicates that on account of the overgrazed

condition of their range the deer are forced to feed largely on sage brush and juniper.

On the winter range on the eastern side of the Kaibab Plateau the deer seemed to be in fairly good condition, but on the western side, where there is a greater concentration of the animals, they were found much emaciated. Within a comparatively small area the carcasses of 23 deer were found, most of which had died of starvation, though some might have been killed by predatory animals. A large number of fawns known to have been born last summer have already died of starvation, and this probably accounts in some measure for the lack of increase in the herds during the year.

The investigations have revealed that there are more deer on the range than the available forage will support and that unless many of the animals are removed the greater part of the feed there will be killed out. The deer are now concentrated on the winter ranges along the basal slopes of the Kaibab Plateau, the higher part of which at this season is deeply covered with snow.

After the creation in 1906 of the Grand Canyon Game Preserve, which has boundaries nearly identical with those of the Kaibab National Forest, no killing of the deer was permitted there until 1924, when a few hundred were removed in this way. They were further protected through the killing of large numbers of the predatory animals that formerly tended to check their increase. From a comparatively small number in 1906, perhaps 3000, the deer increased until in 1922 when it was estimated there were 20,000, perhaps a fourth or a third of

which ranged in summer on the Grand Canyon National Park. In the summer of 1924, a committee appointed by the Secretary of Agriculture to study the problem of dealing with the surplus estimated the number at 30,000, a total that some of the government experts and local residents believed conservative.

This great increase over the original numbers of deer has led to the overutilization and destruction of forage at the present time. Legal complications concerning jurisdiction have thus far prevented carrying out plans initiated by the Forest Service for hunting on a large scale. Even if there should be a material reduction in the numbers of the deer, however, it would take many years, according to the investigators, to restore the full forage-producing capacity of both summer and winter ranges. A few hundred of the deer are killed each autumn under the state law, whereas officials of the Department of Agriculture recommend that thousands be removed in order to prevent the destruction of the forage for all. This destruction has now progressed until all forest reproduction is threatened.

MISSISSIPPI WILD LIFE REFUGE.

Regulations for the administration of the Upper Mississippi River Wild Life and Fish Refuge were signed and issued jointly on June 24 by Secretary of Agriculture Jardine and Secretary of Commerce Hoover. These regulations prescribe the conditions under which hunting and other recreational activities, including fishing and camping, will be permitted on the reservation, the general plan being to allow the public the freedom of the refuge as far as possible, consistent with the conservation of the wild life protected there. The danger from neglected camp fires is especially stressed.

The purchase of lands for the Upper Mississippi Refuge was provided for by Congress in 1924 and \$1,500,000 authorized to be appropriated for the purpose, administration being assigned to the Biological Survey of the Department of Agriculture and, as far as fishes and other aquatic life are concerned, to the Bureau of Fisheries of the Department of Commerce. Areas of overflowed bottom lands along the Mississippi from Rock Island, Ill., to Wabasha, Minn., are being acquired as rapidly as possible in the states of Illinois, Iowa, Wisconsin and Minnesota.

These overflowed lands, mostly unsuited for agriculture, include many islands above which bluffs rise precipitously on

either side of the river from 200 to 400 feet high, and add unusual scenic charm to an area especially adapted to the needs of wild life. Here fur and other wild mammals, birds, and fishes will, under careful conservation, have opportunity to increase in numbers, and the public at the same time will be given within reasonable limits the enjoyment of the sport of hunting and fishing. There are many sloughs and bayous within the limits of the reservation, some of which are navigable to boats of light draft. Many of these become cut off in summer and, in order to save the fish they contain, the Bureau of Fisheries in cooperation with the states sends agents each year to return them to the Mississippi or to carry them to other localities for restocking depleted streams. In this way hundreds of millions of such species as bass, pike, and sunfish are annually rescued by federal and state agencies.

The Mississippi Valley is the great highway for many species of migratory birds, including ducks and other waterfowl, and these find rest and feeding places within the refuge when making their long flights between their summer and winter homes. Quail and some ducks have in the past bred here, and during migration the refuge has been found an ideal place for many species of warblers and other small birds. Among fur-bearing animals inhabiting the refuge are muskrats, minks, raccoons, foxes, and skunks, and in the southern part some opossums. These animals will be of economic importance in the legitimate uses of the refuge.

The pearl-button industry, with a large annual output, finds an important part of its raw material in the mussel shells gathered in this general region. Spawn of some of the shellfish are carried only in the gills of certain fishes, and the mussels that furnish the shells depend for their existence upon the conservation of the fishes frequenting these waters.

THIRTY-FIFTH REFUGE JUST PURCHASED.

Pennsylvania now has thirty-five game refuges, besides several auxiliary refuges. The latest refuge to be established comprises 6500 acres along the Susquehanna River in Susquehanna County.

Pursuant to the usual system in vogue in that state, 1500 acres in the center of the refuge will be enclosed with a single strand of wire and set aside as a sanctuary, the balance being reserved for the use of the public as hunting grounds.—*Arizona Wild Life*, Vol. 1, No. 1.

REPORTS.

FISH CASES.

April, May and June, 1927.

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act.....	23	\$550 00	-----
Trout: over limit.....	39	1,625 00	90
Sunfish: closed season.....	6	90 00	40
Striped bass: over limit and undersized.....	5	130 00	-----
Black bass: undersized.....	1	-----	180
Sacramento perch: closed season.....	1	20 00	-----
Calico bass: closed season.....	1	20 00	-----
Barracuda: undersized.....	3	150 00	-----
Young fish: illegal taking of.....	1	50 00	-----
Commercial Angling License Act.....	29	275 00	-----
Crabs: undersized and females.....	5	60 00	110
Abalone: undersized.....	18	520 00	-----
Crabs: illegal shipment from closed district.....	1	100 00	-----
Crab meat: sale of out of shell.....	1	25 00	-----
Clams: over limit.....	17	340 00	245
Nets, illegal: possession or use.....	21	950 00	60
Sea lions: illegal killing of.....	1	100 00	-----
Illegal shipment via parcel post.....	1	-----	90
Night fishing.....	1	25 00	-----
Illegal fishing: within 250 feet of fishway.....	2	50 00	-----
Fish reservations: fishing in.....	6	125 00	-----
Pollution.....	1	2,000 00	-----
Totals.....	184	\$5,405 00	805

GAME CASES.

April, May and June, 1927.

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act.....	19	\$365 00	-----
Deer: kill doe.....	2	250 00	-----
Deer: closed season.....	16	1,050 00	90
Deer: not retaining hide.....	1	-----	30
Ducks: closed season.....	4	200 00	-----
Mud hens: closed season.....	1	-----	5
Doves: closed season.....	10	400 00	125
Pigeons: closed season.....	4	175 00	-----
Quail: closed season.....	4	75 00	20
Pheasants: closed season.....	5	1,145 00	-----
Nongame birds: killing and possession.....	7	120 00	10
Rabbits (cottontail and brush): closed season.....	21	550 00	10
Tree squirrels: closed season.....	2	25 00	30
Dogs: running deer in closed season.....	1	50 00	-----
Night hunting.....	3	50 00	180
Refuges: possession of firearms in.....	1	25 00	-----
Bird nets: illegal possession of.....	2	50 00	-----
Trespass.....	1	10 00	-----
Fur trapping regulations.....	1	10 00	-----
Totals.....	105	\$4,550 00	530

SEIZURES OF FISH AND GAME.

April, May and June, 1927.

Halibut, pounds	26
Barracuda, pounds	4,324
Striped bass, pounds	792
Catfish, pounds	3
Salt water perch, pounds	150
Sunfish	107
Black bass	14
Trout	704
Carp	240
Sturgeon	1
Calico bass	18
Sacramento perch	1
Crabs	138
Crab meat, out of shell, pounds	150
Clams	770
Abalones	144
Rabbits (cottontail and brush)	84
Tree squirrels	2
Deer meat, pounds	541
Doves	5
Quail	5
Pheasants	5
Ducks	4
Nongame birds	19
Black bass	14

STATEMENT OF INCOME.

For the Period April 1, 1927, to June 30, 1927, of the Seventy-eighth Fiscal Year.

License sales:	Detail	Total
Angling licenses—1926	\$10,807 00	
Angling licenses—1927	129,990 00	
Hunting licenses—1926-27	64,695 00	
Hunting licenses—1927-28	57 00	
Market fishermen's licenses—1926-27	310 00	
Market fishermen's licenses—1927-28	21,740 00	
Trapping licenses—1926-27	206 00	
Wholesale fish packers' and shell fish dealers'—1926-27	65 00	
Game breeders' licenses—1927	75 00	
Fish breeders' licenses—1927	25 00	
Total license sales		\$227,970 00
Other income:		
Court fines	\$11,364 92	
Fish packers' tax	36,429 82	
Kelp tax	5 44	
Fish tag sales	1,168 90	
Game tag sales	2 34	
Miscellaneous sales	15 00	
Interest on bank deposits	371 31	
Total other income		49,357 73
Total income		\$277,327 73

STATEMENT OF EXPENDITURES.

For the Period April 1, 1927, to June 30, 1927, of the Seventy-eighth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal		\$3,630 00	\$357 45	\$106 54	\$4,093 99
Clerical and office	\$344 53	4,590 00	965 63	193 15	6,093 31
Rent			2,216 74		2,216 74
Telephone and telegraph			1,149 31		1,149 31
Postage			1,090 11		1,090 11
Freight, cartage and express			368 37		368 37
Printing	5,431 75				5,431 75
Automobiles	151 72		117 95	1,790 56	2,060 23
Accident and death claims			158 96		158 96
Total administration	\$5,928 00	\$8,220 00	\$6,424 52	\$2,090 25	\$22,662 77
Education and research:					
Director and assistants	\$134 45	\$1,778 33	\$296 16	\$559 53	\$2,768 47
Publicity:					
Director		\$880 00	\$323 54		\$1,203 54
Conservation and protection:					
Chief and assistants	\$105 70	\$1,674 99	\$145 56	\$27 98	\$1,954 23
Clerical and office	4 65	1,272 00	2 00		1,278 65
Rent			116 46		116 46
Automobiles	161 75		178 88	1,509 75	1,850 38
Captains and deputies	955 48	37,384 01	33,587 61	90 87	72,017 97
Patrol launches	366 04	495 00	112 60	22 79	996 43
Lion hunting		405 00	328 56		733 56
Lion bounties			1,610 00		1,610 00
Statistics and game problems	277 28	1,185 00	199 09	630 48	2,291 85
Total conservation and protection	\$1,870 90	\$42,416 00	\$36,280 76	\$2,281 87	\$82,849 53
Commercial fisheries:					
Chief and assistants	\$559 76	\$2,409 99	\$330 23	\$5 70	\$3,305 68
Deputies	6 50	4,450 00	1,182 99	157 95	5,797 44
Patrol launches	565 76	1,170 00	313 26	38 40	2,087 22
Laboratory research	571 44	6,478 68	2,869 04	748 88	10,668 04
Statistical	67 01	1,320 00	102 76		1,489 77
Salmon tagging			63 70		63 70
Botulism			7,500 00		7,500 00
Total commercial fisheries	\$1,770 47	\$15,828 67	\$12,361 98	\$950 93	\$30,912 05
Fish culture:					
Chief and assistants	\$126 28	\$999 99	\$22 50		\$1,148 77
Clerical and office	18 66	960 00	10 65	\$60 05	1,049 36
Rent			94 70		94 70
Automobiles	768 52		308 22	3,728 77	4,805 51
Hatcheries	11,746 72	23,741 01	4,166 76	1,950 52	41,605 01
Hatcheries—additions and betterments				11,858 57	11,858 57
Special field investigation	10 20	1,695 00	534 10		2,239 30
Total fish culture	\$12,670 38	\$27,396 00	\$5,136 93	\$17,597 91	\$62,801 22
Screens, ladders and pollution:					
Chief and assistants	\$14 23	\$2,205 00	\$769 44	\$168 89	\$3,157 56
Game propagation:					
Game farm	\$2,597 70	\$2,385 67	\$251 85	\$1,983 56	\$7,218 78
License commissions			\$14,821 02		\$14,821 02
Total expenditures	\$24,986 13	\$101,109 67	\$76,666 20	\$25,632 94	\$228,394 94

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF APRIL, MAY AND JUNE, 1927.

Compiled by Division of Fish and Game, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt.....	Mendocino, Sonoma, Lake...	Marin.....	Solano, Yolo.....	Sacramento, San Joaquin.....	Alameda, Contra Costa...	San Francisco, San Mateo.....	Santa Cruz.....	Monterey.....
Albacore.....							109,320	443	38,707
Anchovies.....								9	6
Barbacuda.....									
Bonito.....				1,872	841	7,243	2,102		
Carp.....				8,940	40,630	18,215			
Catfish.....							67,612	5,256	12,183
Cutts Cod.....	10,997	5,718			206	1,259	79,439	127	10
Flounders.....	705	13,930					7,280		
Grayfish.....							41,100		
Hake.....							4,271	984	789
Halibut.....	125,391	6,971	44		64				
Hardhead.....							33,570	1,580	
Herring.....							11,668	17,986	9,832
Kingfish.....								541	116,285
Mackerel.....									4,265
Mackerel, Horse.....									
Mullet.....									
Perch.....	4,064		15,162	156	719	586	5,674	5,012	14,138
Pike.....						254		101	12
Pompano.....									
Rock Bass.....	24,589	17,052					221,034	132,659	198,866
Rockfish.....	24,965	3,573					82,759	116,936	140
Sablefish.....							145,848	117,428	463,133
Salmon.....	983,271	257,871		37,443	127,720	95,319	253,730		180
Sardabs.....		2,478					139,969	36,100	4,186,096
Sardines.....			70						117
Sculpin.....									
Sea Bass—Black.....			97					1,792	1,373
Sea Bass—White.....							119,646		
Shad.....				43	455	201			
Shad—Buck.....				307,423	103,985	1,441,134			
Shad—Roe.....				348,226	112,414	1,404,240			
Sheepshead.....									
Skates.....							51,300		1,402
Skilpack.....									
Smelt.....	7,952		11,664			1,956	46,799	37,909	7,727

Sole	93	40,016				77	2,570,821	12,487	4,227
Spittail									
Striped Bass									
Suckers									
Swordfish									
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot									
Whitebait									
Whitefish	61,063								704
Yellowtail									
Miscellaneous	247								733
Total fish	1,303,337	347,609	28,346	733,648	483,768	3,056,336	4,049,544	490,095	5,060,925
Crustaceans:									
Crabs									
Shrimps	174,496								
Spiny Lobsters									
Mollusks:									
Abalones									
Clams—Cockle									
Clams—Mixed	627								
Clams—Pismo	1,071	170							
Clams—Softshell									
Cuttlefish		519							
Mussels									
Oysters—Eastern									
Squid									
Totals	1,379,531	348,298	338,973	733,648	483,768	3,066,446	5,191,704	800,474	11,257,949

All amount shown in pounds unless otherwise specified. Albacore and skipjack cleaned.
 *3,104 dozen. *84,150 shell oysters. *36,743 dozen. *456,750 shell oysters. *2,691 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF APRIL, MAY AND JUNE, 1927—Continued.

Compiled by Division of Fish and Game, Department of Commercial Fisheries.

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego	Total Mexican brought into California
Albacore		217,688	414	33,322	251,494			
Anchovies		16,001		1,350	165,821		26,173	146,454
Barracuda		1,877,722	106,919	505,267	2,491,862	120,281	155	
Bonito	1,739	39,673	2,105	41,519	83,219			
Carp	2				12,058			
Catfish					67,785			
Cutlass Cod	16	57			101,839			
Flounders		803	68		96,547			
Grayfish		31,185			38,465			
Hake					41,100			
Halibut	55,700	101,286	13,526	16,281	325,243		185,742	185,742
Hardhead					64			
Herring		83,479	432	1,799	35,150			
Kingfish		538,341	64,242	227,778	125,196			
Mackerel	78	61,412			947,265		1,090	1,090
Mackerel—Horse		887			65,677			
Mullet		9,096		2,327	3,214	700	5,408	6,108
Perch	286				54,018		220	220
Pike					1,129			
Pompano		2,126		294	2,533			
Rock Bass	991	91,688	20,357	57,928	170,964	12,366	15,620	27,986
Rockfish	35,523	576,838	4,744	483,927	1,695,232	73	3,001	3,074
Sablefish	18	175			288,566	540		540
Salmon					2,227,533			
Sardines		4,420	100		260,908			
Sardines	180	12,049,411		2,428,548	19,740,374			
Scupin		21,803	157	7,552	29,629			
Sea Bass—Black	350	2,694	13,405	27,874	44,323	100	14,169	14,269
Sea Bass—White	8,834	211,496	3,035	94,137	320,764	95,913	171,302	267,215
Shad					120,345			
Shad—Buck					1,852,542			
Shad—Roe					1,864,880			
Sheepshead		18,733	42	955	19,710			
Skates		2,338			55,040			
Skipjack						511,684	1,353,110	1,864,794
Smelt	17,576	92,454		7,297	231,334			

Sole.....	74,609	1,468	568	457	2,710,833		
Spittail.....					115		
Striped Bass.....					230,163		
Suckers.....					497		
Swordfish.....					4,955		
Tuna—Bluefin.....		2,347		2,608			
Tuna—Yellowfin.....		766,603		217,462			
Turbot.....					984,065		
Whitebait.....					4,566,911		7,721,324
Whitefish.....		37,086			1,304		
Yellowtail.....		173,483	41	32,664	85,755		
Miscellaneous.....	6,647	24,312	231	143,707	615	1,724	2,339
					91,897	129,633	221,530
					415	5,760	6,175
Total fish.....	202,549	17,957,105	230,386	4,355,103	38,278,751	5,401,495	10,469,015
Crustaceans:							
Crabs.....							
Shrimps.....					61,020,912		
Spiny Lobsters.....					396,468		
Mollusks:						69,992	69,992
Abalones.....	4,098						
Clams—Cockle.....					881,948		
Clams—Mixed.....					2,056		
Clams—Pismo.....		384			20,199		
Clams—Softshell.....	61,838				61,838		
Cuttlefish.....					42,937		
Mussels.....	61				15,566		
Oysters—Eastern.....	20				15,167		
Squid.....					7118,998		
					5,537,643		
Totals.....	268,566	17,957,637	230,386	4,355,103	46,392,483	5,401,495	10,559,007

642,538 dozen. 7540,900 shell oysters.

CORRECTION.

In the October, 1926, issue of *California Fish and Game*, page 214, California Fresh Fishery Products for months of April, May and June, 1926, item of Marlin, 764 pounds Monterey and 8023 pounds Los Angeles, total catch 8787 pounds, should read "Mackerel, Horse," instead of "Marlin."

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